Southern California Academy of Sciences 2007 Annual Meeting Abstracts

1. TROUBLED WATERS: THE BIOLOGICAL INVASION OF SOUTHERN CALIFORNIA WATERWAYS

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Throughout North America the spread of non-native species threatens the ecological integrity of forests, grasslands, and waterways and causes significant economic stress in our communities. Identification of aquatic nuisance species is key in addressing the threat to southern California aquatic ecosystems and water delivery systems. This presentation will profile some of the aquatic nuisance species in southern California providing biological characteristics, life history, environmental requirements and the potential ecological impacts they pose.

2. THE INVASIVE *POTAMOPYRGUS ANTIPODARUM* (NEW ZEALAND MUDSNAIL) IN CALIFORNIA WITH DATA FROM THE UPPER OWENS RIVER WATERSHED

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Potamopyrgus antipodarum are small, dark colored, dextrally spiraled, aquatic mudsnails (Family: Hydrobiidae) native to New Zealand. They have a brood pouch (distinguishing them from the other two species of *Potamopyrgus*), tolerate a wide range of water temperatures and salinities, reproduce parthenogenetically, and have an operculum which allows them to survive up to 30 days out of water in a damp environment. It is known that *P. antipodarum* have established populations in Australia, Tasmania, most European countries, and the United States. Data collected from nine sites in the Upper Owens River Watershed from May through November 2002, showed that *P. antipodarum* were the dominate macroinvertebrate at some sites with densities greater than 700,000 per m^2 and comprised over 99% of the benthic macroinvertebrate fauna. *P. antipodarum* were present in low densities in May and increase through summer and early fall. At the site with the highest *P. antipodarum* density, individuals of reproductive size were present and young were being recruited in each month, May through November 2002.

3. MUDSNAILS INVADE THE 'BU: A CASE STUDY IN INSTITUTIONAL RESPONSES TO INVASIONS

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In May 2006, New Zealand mudsnails, *Potamopyrgus antipodarum*, were discovered during routine macroinvertebrate monitoring in Malibu Creek, located in the Santa Monica Mountains of Southern California. We describe the initial discovery of *P. antipodarum*, and agency efforts to determine the extent of and response to the invasion. We also discuss the need to manage the threat invasives pose in a more holistic manner, rather than applying a species-by-species approach. Finally, we present a brief overview of invasive species management actions and discuss some of the challenges to implementation.

Agencies were able to coordinate and implement a rational, rapid response to the invasion including (1) a "mudsnail summit" to develop coordination between agencies, (2) a 44-site survey to determine the extent of the invasion, (3) a literature review on mudsnails, and (4) the development of a unified education and outreach effort. It is clear that the ability of agencies to coordinate their actions, efforts, and resources is a key factor in the *rapid* response to an invasion. Now that *P. antipodarum* has become established in the Malibu Creek watershed, continued management will require on-going monitoring, education, and research.

This episode has made it clear that managing invasives post- establishment is inadequate. The investment of time and resources necessary to implement on-going monitoring, education and control measures on a species-by-species basis is neither effective, nor efficient. Management must begin with stopping potential invasions before they occur, specifically by managing the pathways of introduction. Additionally, recognizing that despite our best efforts invasions will occur, we must make early detection of invasives an integrated part of habitat monitoring and restoration efforts.

4. DEVELOPMENT OF BIOLOGICAL CONTROL FOR THE NEW ZEALAND MUD SNAIL

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The New Zealand Mud Snail (NZMS; Hydrobiidae: *Potamopyrgus antipodarum*), is spreading to streams, rivers and other water bodies across the western region of the U.S. The NZMS can interfere with aquatic invertebrates (including federally listed species), anadromous salmonids, and other fish dependent on invertebrates as resources. We propose to investigate biological control of NZMS by a specialized castrating trematode parasite, *Microphallus* sp. This could be a safe, sustainable and cost-effective means to suppress NZMS abundance in infested waters and to reduce the risk of further invasion. *Microphallus* sp. is a promising control agent for NZMS because: 1) It castrates the host, and enhances mortality through behavioral changes that increase susceptibility to avian predators. 2) *Microphallus* shows an extremely high host specificity and local adaptation to clones of snail hosts, which reduces the risk of infection in non-target species. Our evaluation of *Microphallus* sp. as a biocontrol agent for NZMS in the U.S. will include: 1) Developing demographic models to characterize relationships between *Microphallus* infection and NZMS abundance and reproduction in Australasia (source of snail and parasite), 2) Determining infectivity and efficacy of *Microphallus* to North American NZMS populations, and 3) Evaluating host specificity using host-range tests with non-target North America mollusks and potential impacts on avian hosts. The development of an effective and politically-acceptable biological control program will require several years of testing and evaluation before it can be implemented in the field. Thus, it is critical that a control program be evaluated very soon, before NZMS infestations dominate benthic assemblages throughout North America.

5. EFFECTS OF URBANIZATION ON THE DISTRIBUTION AND ABUNDANCE OF AMPHIBIANS AND INVASIVE SPECIES IN SOUTHERN CALIFORNIA STREAMS

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Urbanization negatively affects natural ecosystems in many ways, aquatic systems in particular. Urbanization is also cited as one of the potential contributors to recent dramatic declines in amphibian populations. However, few field studies have examined amphibian communities in urban areas, and virtually none have addressed urbanization and stream amphibians. From 2000–2002, we determined the distribution and abundance of native amphibians and exotic predators and characterized stream habitat and invertebrate communities in 35 streams in an urbanized landscape north of Los Angeles. We measured watershed development as the percentage of area within each watershed that was occupied by urban land uses. Streams in more developed watersheds often had exotic crayfish (*Procambarus clarkii*) and fish and had fewer native species, such as California newts (*Taricha torosa*) and California treefrogs (*Hyla cadaverina*). These effects seemed to be particularly evident above 8% development, a result coincident with other urban stream studies that show negative impacts beginning at 10–15% urbanization. For Pacific treefrogs (*Hyla regilla*), the most widespread native amphibian, abundance was lower in the presence of

exotic crayfish, although direct urbanization effects were not found. Faunal community changes in urban streams may be related to changes in physical stream habitat such as increased water depth and flow, leading to more permanent streams. Variation in stream permanence was particularly evident in 2002, a dry year when many natural streams were dry, but urban streams were relatively unchanged. Urbanization has significantly altered stream habitat in this region and may enhance invasion by exotics and negatively affect diversity and abundance of native amphibians.

6. AMPHIBIAN LIFE IN RESPONSE TO THE ACTIVE REMOVAL OF EXOTIC SPECIES IN STREAMS OF THE SANTA MONICA MOUNTAINS

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Exotic species have been shown to negatively impact stream-breeding amphibians in the Santa Monica Mountains. The exotic red swamp crayfish (Procambarus clarkii) for example have been known to eat amphibian eggs and larvae and have also been known to attack adult amphibians. For the past four years, we have been intensively trapping the exotic red swamp crayfish in an attempt to help native stream-breeding amphibians regenerate their populations. Due to overall stream size, the total removal of crayfish was unrealistic in our short-term expectations. As a result of this, we focused on the removal of crayfish from habitats that appeared to be optimal for amphibian breeding. Throughout the course of our project, over four thousand crayfish were trapped and removed. We also surveyed amphibians throughout the year and have collected data that has enabled us to compare pre-trapping surveys to those that were conducted during and after the four-year removal effort. The California newt (Taricha torosa) has long generation gaps making it increasingly difficult to determine the effectiveness of trapping exotic species in short term periods. The California tree frogs (Hyla cadaverina), however, have much shorter generation times allowing us to use the Hyla cadaverina as a way to measure amphibian health in the stream. Because of this, our research suggests that Hyla cadaverina numbers have increased significantly both during and after years when crayfish were intensively trapped.

7. CALIFORNIA RESPONSE TO THE DISCOVERY OF QUAGGA MUSSEL/ ZEBRA MUSSEL IN LAKE MEAD

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On January 6, 2007, Quagga mussel was discovered in Lake Mead, NV. The State of California responded by establishing a formal Incident Command System. The Departments of Fish and Game, Food and Agriculture, Water Resources and Boating and Waterways partnered with the U.S. Fish and Wildlife Service, Metropolitan Water District and San Diego Water Authority in this effort. Surface and dive surveys commenced immediately in southern California and adult Quagga mussels were found in Lake Havasu and in the Colorado River Aqueduct. Border check stations at Yermo, Needles and Vidal Junction have increased operating hours to 24/7 to inspect all boats originating in Lakes Mead, Mohave and Havasu. In order to maximize effectiveness, a Science Advisor was appointed, and a Scientific Advisory Panel was convened to discuss eradication potential and options, containment strategies, and long term detection and monitoring needs. Numerous outreach materials have been developed and distributed to boaters and other stakeholder groups, including a letter to all registered boaters, establishment of a hot-line, boat cleaning guidance flyers and warning posters.

State agencies have maintained contact with the National Park Service to stay abreast of activities in Lake Mead, and provide boater survey information collected from infested boats entering California. Approximately $2.5 million has been dedicated to the first 6 months of this effort.

8. DISTRIBUTION, HABITAT UTILIZATION, AND REPRODUCTIVE PATTERNS IN *CAULACANTHUS USTULATUS* (CAULACANTHACEAE, GIGARTINALES), A NEWLY ESTABLISHED SEAWEED ON SOUTHERN CALIFORNIA SHORES

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Southern California rocky intertidal macrophytes have experienced dramatic shifts in community structure over the last several decades including the recent (1999) appearance of the red alga *Caulacanthus ustulatus*. This species had previously been reported in the Northeastern Pacific only in Baja California, San Francisco Bay, Washington, and British Columbia. Molecular studies indicate that specimens from Washington and southern California are identical to material from Asia, its native location, and from northern France where the species has been introduced. Its absence from previous surveys and its genetic affinity with Asian specimens suggests that southern California populations of *Caulcanthus* may not be indigenous. Focusing on southern California populations of *Caulacanthus*, the goals of this study were to determine its: 1) Bight-wide distribution 2) abundance and habitat utilization at two local sites, and 3) reproductive patterns. Our surveys and specimens obtained from colleagues revealed that *Caulacanthus* is widespread along the southern California mainland from Los Angeles County to San Diego Bay and on both Catalina and Anacapa Islands. Abundance sampling at two Orange County locations over the last four years has shown that *Caulacanthus* is confined to mid and upper intertidal habitats where it is a persistent contributor to cover in algal turf communities. *Caulacanthus* grows on a variety of substrata including rock, mussel and barnacle surfaces, turf-forming macro-algae, and rockweed bases. Examination of thalli from local sites revealed that the majority of *Caulacanthus* specimens are sterile but that tetrasporangial plants exist, suggesting that both vegetative and spore recruitment are likely mechanisms for dispersal.

9. MANAGING THE SPREAD OF AQUATIC NUISANCE SPECIES THROUGH HACCP PLANNING

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Hazard Analysis and Critical Control Point (HACCP) planning is a process used to identify pathways for the introduction of aquatic nuisance species (ANS) in natural resource management activities. The HACCP process is an important tool for agencies and organizations that have the potential to inadvertently move ANS from one watershed to another through their natural resource management activities. Developing an effective HACCP plan entails using a team approach to work through the 5 steps of HACCP planning—1) describe the activity, 2) identify potential hazards, 3) diagram the flow of steps for the activity, 4) fill out a hazard analysis worksheet, and 5) complete the HACCP plan form. The U.S. Fish and Wildlife Service provides training and technical assistance to natural resource managers for creating HACCP plans. Additional resources are available on the internet at http://www.haccp-nrm.org/, including a library of completed plans and HACCP Planning Wizard software.

10. PARASITES IN FOOD WEBS AS BIOINDICATORS OF ENVIRONMENTAL CONDITIONS

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Parasites are more sensitive than commonly thought. Stressful conditions can decrease parasite diversity faster than host diversity. This is for a few reasons. Firstly, parasites can be sensitive to pollution and they can be lacking from contaminated areas. Secondly, parasites require abundant host populations, so over fishing or disturbance can reduce parasitism. Finally, parasites with complex life cycles are dependent on diverse food webs. Removal of top predators and other simplifications to food webs can reduce the diversity of parasite communities. Sometimes, parasites are easier to measure than host communities and can act as positive bioindicators of ecosystem complexity and health. We have developed this approach to help monitor local estuaries and feel it has promise for other systems as well.

11. RELATIONSHIPS BETWEEN ENDOHELMINTH ASSEMBLAGES OF FISH AND WATER QUALITY

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Fish are often target species in environmental monitoring programs. To a lesser extent, parasites of fish have functioned as bioindicators of complex interactions between their hosts and the contaminants that

they are exposed to in their habitat. I examined host-parasite systems in water bodies with varying levels of contaminants to assess the relevance of using endoparasites to monitor aquatic ecosystem health along with such traditional tools as water and sediment analyses, composition of the benthic infaunal community, and tissue analyses. I studied endohelminth assemblages of white croaker *Genyonemus lineatus* from Los Angeles Harbor and Pacific sanddab *Citharichthys sordidus* from Santa Monica Bay. Data on helminth populations infecting these fishes are presented relative to levels of contaminants known in the habitat of their hosts. My findings suggest that negative impacts of contaminants on invertebrate host communities can contribute to the lower abundance of helminths infecting fish from more polluted habitats. One cestode species, *Lacistorhynchus dollfusi* showed potential as a bioindicator of pollution exposure in Pacific sanddab.

12. THE BIOMASS OF PARASITES AND THE ENERGETICS OF ECOSYSTEMS

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To resolve the paradox that parasites have strong impacts to ecosystems, despite their apparent small biomass, we quantified the biomass of free-living and parasitic species in three Pacific Coast estuaries. Parasite biomass is unquantified in nature. 147 parasite species comprised 0.1 to 1% of the total animal biomass. While this seems small, parasite biomass exceeded that of important groups, such as birds, fishes, shrimp, or polychaetes. The biomass controlled by parasitic castrators sometimes exceeded that of their uninfected hosts. The annual productivity of the largest component of parasite biomass exceeded standing crop biomass by 3× and exceeded that of birds 3–10×. These results suggest that the effect of parasites on ecosystems may result from a surprisingly large biomass relative to their high trophic level.

13. FISH PREDATION ON TREMATODE CERCARIAE IN A CALIFORNIA ESTUARY

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In salt marsh ecosystems where the snail *Cerithidea californica* is infected with digenean trematodes, billions of cercariae are shed into the estuary every day. But, a large percentage of cercariae do not reach their second intermediate hosts. Cercarial mortality factors are little studied and the role of predators as a mortality source is unknown. Our laboratory studies indicate that several zooplanktivorous fishes are potential predators. Seven local estuarine fish species were brought into the lab and offered cercariae from twelve trematode species that reside with them in the marsh. Thirty minutes after the fish were presented with cercariae, they were examined for the presence of cercariae in the gut. Most of these fishes rapidly engorged on cercariae. We also examined the relationship between the size of these fishes and cercarial feeding behavior. The species of fishes that preyed on cercariae in the lab were then examined in the field. We collected juvenile fishes form very shallow water on the rising tide. Cercariae are released from snails under these conditions. Fishes were dissected in the field to look for the presence of cercariae in their guts. Out of approximately 70 fish dissected in the field, three had cercariae in their foregut, specifically in the esophagus. The role of fishes as predators of cercariae and the actual biomass the cercariae contribute to the food webs of these estuaries will be discussed.

14. DEVELOPMENT OF *ASCAROPHIS* SP. (NEMATODA: CYSTIDICOLIDAE) TO MATURITY IN *GAMMARUS DEUBENI* (AMPHIPODA)

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Parasitic nematodes of the Order Spirurida are with some rare exceptions, heteroxenous; adult worms are present in a vertebrate host and infective third-stage larvae develop in various arthropods. An exception is *Ascrophis* sp. (Cystidicolidae), which is present as an adult in the hemocoel of the intertidal amphipod *Gammarus deubeni* found in Passamaquoddy Bay, New Brunswick, Canada. *Ascarophis* sp. is similar in morphology to *A. arctica*, which is found in the stomach of marine fish of Passamaquoddy Bay, and has been found as an adult in *G. oceanicus* in the Baltic Sea. In experimental infections of *G. deubeni*, first stage larvae penetrate host muscle and molt twice to become third stage larvae. Third stage larvae

either remain in the muscle or move into the hemocoel where they molt twice and become adult worms. At 10–12°C gravid female worms are present at 80 days post-infection. Intestinal lumens of adult worms include host lipid deposits and hemocytes. Host hemocyte congregations are present on shed cuticles, *Ascarophis* eggs, and in some cases adult worms were found dead surrounded in melanin-like deposits. The direct development of *Ascarophis* in the invertebrate host may be "extreme precocity," (Anderson and Bartlett 1993), which is thought to enhance transmission when there is little time for parasite development in the definitive host. However, in experimental conditions, second generation juvenile *G. deubeni* have become infected, possibly through consumption/cannibalism of infected amphipods, suggesting that the definitive fish host may no longer be needed for parasite transmission.

15. PARASITE MANIPULATION OF BRAIN MONOAMINES IN KILLIFISH

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Trematode parasites (*Euhaplorchis californiensis*) encyst around the brains of their second intermediate hosts, California killifish (*Fundulus parvipinnis*). As a result, infected fish display conspicuous swimming behaviors, such as flashing and surfacing, which increase their predation by avian definitive hosts. Yet the neuroendocrine mechanisms that drive these behavioral changes remain a mystery. Monoamine neurotransmitters such as dopamine (DA) and serotonin (5-HT) regulate many social and locomotory behaviors in fishes. We used micropunch dissection and HPLC to analyze concentrations of 5-HT, DA and their metabolites 5-hydroxyindoleacetic acid (5-HIAA) and 3,4-dihydroxyphenylacetic acid (DOPAC) in the brains of uninfected, naturally infected and experimentally infected fish. We measured monoamine activity (calculated as the ratio of monoamine to metabolite) in the hippocampus, striatum, hypothalamus and raphe nuclei. DA and 5-HT activity differed between uninfected and infected killifish overall, supporting our hypothesis that *E. californiensis* may alter brain monoamines to modify host behavior. Moreover, all four brain regions showed metacercarial density-dependent changes in monoamine activity in both experimentally and naturally infected fish (Table 1). In particular, high parasite density was associated with increased DA activity in the hypothalamus and decreased 5-HT activity in the hippocampus and raphe nuclei. Furthermore, a strong correlation appeared between increasing parasite density and decreasing raphe 5-HT activity in infected fish. Altered monoamine activity in these 3 brain regions could result in modified social and locomotory behavior in infected killifish.

16. THE INFLUENCE OF ECTOPARASITES AND WASTEWATER DISCHARGE ON THE ENDOCRINE STRESS RESPONSE IN MARINE FISHES

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The southern California marine environment is subjected to numerous inputs of pollution, and little is known about pollution effects on infestation of parasites on marine fishes. Poor water quality and pollution exposure can be chronic stressors, potentially decreasing a fish's defense system and increasing its susceptibility to diseases and parasites, while disease and/or parasitic infestation can potentially further exacerbate the stressed condition. Pollutants may also have direct effects upon several targets along the neuroendocrine hypothalamo-pituitary-interrenal (HPI) axis, affecting production of the stress hormone, cortisol. We evaluated marine fish (in particular California scorpionfish, *Scorpaena guttata*) and their associated parasites as potential bioindicators of environmental stress, and also assessed the ability of the HPI axis to normally respond to delivered stressors. Fish were collected by otter trawl from stations adjacent to and away from the Orange County Sanitation District (OCSD) outfall, blood was collected (and stored at −80°C until assayed for cortisol), and fish were frozen and later inspected for ectoparasitic infestation. Interestingly, when sampled from locations in the vicinity of the OCSD outfall, fish exhibited relatively higher parasite prevalence coincidentally with significantly impaired function of their HPI axis, as they could not produce normal surges in cortisol in response to catching stress.

17. THE EFFECTS OF THE ECTOPARASITIC ISOPOD *ELTHUSA CALIFORNICA* ON THE RESPIRATION OF THE SURF PERCH *CYMATOGASTER AGGREGATA*

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Elthusa californica is an ectoparasite that resides in the gill cavity of *Cymatogaster aggregata*, and feeds off of the gill filaments to consume the blood that flows through the gills. Literature on the effects of the parasite and the stress it causes the host is lacking, therefore, this study quantifies the consequences of parasitism on the respiration rate of *Cymatogaster aggregata*. The fish were tested in five groups: fish with no isopods, fish with 1 isopod left on, fish with 1 isopod taken off, fish with 2 isopods left on, and fish with 2 isopods taken off. Each group of *Cymatogaster aggregata* was tested in ambient, 10%, and 5% oxygen concentrations where the amplitude of the mouth and the frequency of the opercular beats were observed. Gills were extracted to quantify gill damage, which was then correlated to the respiration rates. Regression tests demonstrated that this correlation had no significant difference between the five groups tested. This indicates that parasitism does not cause an intolerable amount of stress during respiration.

18. HISTORIC MERCURY DEPOSITION WITHIN THREE SOUTHERN CALIFORNIA SITES

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Mercury is a naturally occurring element in the earth's crust and may be released through natural sources, such as volcanic eruptions, or through anthropogenic activities, including gold mining, biomass burning, and coal-burning power plants. Once emitted into the environment, mercury may be transformed into methylmercury, the toxic form of mercury that is biomagnified in the aquatic food web. In the U.S., mercury is one of the most ubiquitous pollutants; 44 states and one territory report fish consumption advisories for mercury in at least one water body, including several sites in southern California. Despite the importance of mercury contamination to local watersheds, the relative abundance and magnitude of long- and short-range mercury sources are unknown. To address this question, historic mercury deposition was analyzed in dated sediment cores from three southern California sites: Mugu Lagoon (a coastal estuary in Ventura county), Big Bear Lake (a recreational lake in San Bernardino county) and Crystal Lake (a natural lake in the San Gabriel mountains). Potential sources of mercury varied between sites: urban runoff was the dominant mercury transport mechanism in Mugu Lagoon, while emissions from a cement factory in Big Bear Lake were correlated with increased mercury levels, and in Crystal Lake mercury peaks were associated with historic fires. In all three sites, mercury was positively correlated with organic content (Mugu Lagoon, r=85%; Big Bear, r=75%, Crystal Lake: r=60%), creating a long-term reservoir for mercury in each site, which may be methylated and magnified in fish tissue for many generations.

19. HIGH-RESOLUTION THIN-SECTION PHOTOMICROGRAPHY ANALYSIS OF A GLACIAL-AGE SEDIMENT CORE FROM BALDWIN LAKE, SOUTHERN CALIFORNIA: A LOOK AT SOME INITIAL RESULTS

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Digital image analysis of thin-section photomicrographs allows an "*in situ*" high-resolution study of lake sediment textures and types. A micro-sedimentological and high-resolution digital gray-scale imagery analysis of drill core (BLDC04-2) from Baldwin Lake, Southern California, is used to investigate variations between massive and laminated sediment units as well as to examine sediment contacts. Study of thin-sections from massive sediment units reveal a heterogeneous sediment fabric lacking any distinct structures or textures. Surprisingly, the thin-sections from the laminated sediment units also lack any

distinguishable features. Sediment contacts are typically marked by gradual to sharp changes in sediment color. Conversely, gray-scale digital image analyses of the sediment thin-sections show a high degree of variability within both the massive and the laminated sediment units. This variability will be explored using wavelet time-series analysis of the grayscale data to investigate the potential relationship between lake sedimentation and climate forcing (e.g., ENSO, PDO, solar forcing). Gray-scale analysis shows that sediment contacts are characterized by sharp to gradual shifts in values.

The results obtained from this study will be compared with high-resolution grain-size data, magnetic susceptibility, and loss on ignition data. Using these sediment analyses, we aim to answer several questions: 1) what is the process of sedimentation during massive and laminated units; 2) is there a sediment-climate connection; and, 3) how does our interpretation fit with existing sediment studies from arid environment lakes.

20. THE PALEOENVIRONMENT OF BURGESS SHALE-TYPE DEPOSITS: FROM SOUTHERN CALIFORNIA TO SOUTH CHINA

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Burgess Shale-type (BST) deposits preserve "soft", nonmineralized tissues in addition to the shells, teeth and bones of which the fossil record is almost exclusively comprised. For this reason, they offer a remarkable window on the "Cambrian Explosion", the initial Phanerozoic radiation of the metazoa that defines the Neoproterozoic-Cambrian transition, and their biotas form the foundation of large scale evolutionary and ecological models. Clearly, BST deposits represent significant and unexplained deviations from the constraints that govern the typical operation of the fossil record. Microstratigraphic investigation of Early and Middle Cambrian BST deposits of western Laurentia and south China indicates that BST deposits occurred at discrete loci only when a specific set of paleoenvironmental criteria was satisfied. Constraints of the physical depositional environment exerted a primary control: BST intervals occur in a specific physical depositional window at the distal margin of scour, where re-working was absent, yet deposition was event-driven and rapid, and consisted of exclusively fine-grained sediments (<30 μ). Within this favorable physical environment, the chemistry of the benthic environment exerted the next important control, with exceptional fossilization occurring only under anoxic benthic conditions. Finally, the mineralogic and ionic composition of sediments and porewaters, and sediment permeability determined what microbial reactions were favored and the extent to which each could progress. These results suggest that BST deposits represent a single phenomenon that was regulated by microenvironmental parameters.

21. LATE QUATERNARY VEGETATION HISTORY OF THE MOJAVE COLORADO DESERT ECOTONE AT JOSHUA TREE NATIONAL PARK

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Much of what is known about the vegetation history of semi-arid North America comes from the analysis of fossil (*Neotoma*) packrat middens, with a surprising number of these studies conducted in National Parks. Midden researchers have tended to work in National Parks, not only because of their biodiversity, protected status, and accessibility, but also because the Parks have the infrastructure to readily broadcast novel research results to both the scientific and lay public. However, the region in and around Joshua Tree National Park (JTNP) in southern California, USA represents a conspicuous gap in midden coverage. This study represents the first paleovegetation record for JTNP and helps to fill a gap in our knowledge of the vegetation history of the southwestern United States in response to late Quaternary climate change. Macrofossil analysis of 34 middens collected from upper desert elevations (930–1360 m) provides a record of vegetation change along the Mojave-Colorado Desert ecotone spanning the last ~34,000 years. Late glacial assemblages were dominated by *Juniperus osteosperma*, *Juniperus californica*, *Pinus monophylla*, *Quercus cf. john-tuckeri* and *Quercus cf. turbinella* with an understory of *Cercocarpus ledifolius* var. *intermontanus*, *Purshia tridentata* var. *glandulosa*, *Artemisia bigeloviiltridentata*-type, *Encelia*, *Ericamerica cuneata* var. *spathulata*, *Peucephyllum schotti*, and *Yucca brevifolia*. Several of these species are

present at the site today, reflecting considerable stability in the flora. Ten samples dating from 13,880 to 8480 cal years BP document changes associated with the glacial-interglacial transition. This period is marked by the arrival of several new species including *Prunus fasciculata*, *Rhus*, *Acacia greggii*, and the grasses *Bothriochloa barbinodis*, *Bouteloua barbata*, *Bouteloua* cf. *curtipendula*, and *Bouteloua* cf. *gracilis*. During the middle Holocene (8000–4000 cal yr BP) *J. osteosperma*, *Cercocarpus ledifolius* var. *intermontanus*, and *Purshia tridentata* disappear and are replaced by increasingly xeric-adapted species including *Ambrosia ilicifolia*, *Lycium*, *Larrea tridentata*, *Simmondsia chinensis*, *Coleogyne ramisissima*, and *Chenopodium*, indicative of a trend towards increased aridity.

22. CONTEMPORARY WATER QUALITY AND SEDIMENT PROPERTIES OF SOUTHERN CALIFORNIA LAKES

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Lakes are critical resources in Southern California, serving as habitat for a wide array of species, providing recreational opportunities for the region's vast population, and playing key roles in flood control and water supply. Agricultural, industrial, municipal and urban/suburban development in the region has altered the characteristics of the watersheds, streams and lakes, however. This study will summarize water quality in a number of lakes in Southern California, with particular emphasis on sediment properties, the release of nutrients from sediments via internal recycling, and the role that nutrient release from sediments plays in lake nutrient budgets.

23. FLOODS, FIRES, AND HUMANS: ASSESSING 150 YEARS OF RAPID DEPOSITIONAL EVENTS IN A SMALL ALPINE LAKE, SOUTHERN CALIFORNIA

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Sediments from a small, natural alpine lake in Southern California are examined to test the hypothesis that large, flood-producing precipitation events generate distinct sediment layers. If validated, a record of paleo-storm activity for Southern California can be reconstructed using longer sediment records. A variety of sedimentological analyses indicate that 6 rapidly deposited layers (RDL's) were generated over the past 150 years. Although these six layers contain similar characteristics, they cannot be explained by simple comparison to historic precipitation or river discharge records. A more detailed investigation of human and fire activity over the past 150 years in the drainage basin indicates that other disturbances besides large, flood-producing precipitation events can generate similar sediment layers. In fact, four of the six rapidly deposited layers are associated better with human and fire activity than large, flood-producing precipitation events. These results show that caution must be used when assigning historic-age RDL's to flood events. Without considering the impact of human and fire activity, in the appropriate environment, researchers may misinterpret the mechanisms, which pre-condition the substrate for increased susceptibility to erosion such as human disturbance and fire activity.

24. RECONSTRUCTING LATE PLIOCENE TO MIDDLE PLEISTOCENE DEATH VALLEY LAKES AND RIVER SYSTEMS AS A TEST OF PUPFISH (CYPRINODONTIDAE) DISPERSAL HYPOTHESES

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During glacial periods, Death Valley was the terminus for the Amargosa, Owens and Mojave Rivers. Geological and biological studies tend to support this along with a hydrologic link to the Colorado River that allowed pupfish dispersal throughout southeastern California and western Nevada. Recent mDNA studies support a common regional pupfish (*Cyprinodontidae*) ancestry that diverged 3–2 Ma. Tephrochronologic and paleomagnetic data are presented to test the paleohydrologic connections with

respect to Death Valley during successive glacial periods: (1) the late Pliocene to early Pleistocene, (2) early-middle Pleistocene, and (3) middle to late Pleistocene. We conclude that 3–2 Ma a narrow lake occupied the ancient Furnace Creek basin and that Death Valley was not hydrologically connected with the Amargosa or Mojave Rivers. Paucity of data does not allow us to evaluate an Owens River connection to Death Valley 3–2 Ma. Previous studies show that Death Valley was not hydrologically linked to the Amargosa, Owens or Mojave Rivers 1.2–0.5 Ma. No evidence was found that Lake Manly backflooded up the Mojave River 0.18–0.12 Ma, although surface water flowed from the Amargosa and Owens Rivers to Death Valley at this time. A hydrologic link to the Colorado River in the last 3–2 m.y. was not found. Therefore, the hypothesis that pupfish dispersed or were isolated by severed paleohydrologic connections is not supported; however, sparse and disputed data suggest a fluvial system connected Panamint (Owens River), Death, and Amargosa valleys before 3 m.y. ago.

25. ON-GOING PALEOENVIRONMENTAL STUDIES ON LAKES FROM CENTRAL CALIFORNIA

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Work in progress is presented for three lakes occupying two drainage basins in Central California. The most mature study entails the testing of a recently published, Holocene lake-level history from Tulare Lake, a lake fed by major rivers sourced in the high elevation, southern Sierra. New data are presented here from cores acquired in the Summer of 2005. Samples were taken at 1 cm intervals and analyses include total organic and inorganic carbon analysis (loss-on-ignition method), magnetic susceptibility, and ostracode paleontology. Initial results support the published model; deeper lakes occurred in the early Holocene (low TOC) and the later Holocene was characterized by shallower lake levels (higher TOC with frequent large excursions from the mean value). Initial paleontological results from Buena Vista Lake, a lake higher up in the same drainage system, support earlier hypotheses of a much wetter, colder San Joaquin Valley during pluvial episodes over the past several hundreds of thousands of years, including intervals when fir may have grown on the valley floor. A 40 m core was taken from North Soda Lake basin in the Carrizo Plain. This core will potentially yield a paleoenvironmental record representing a very small drainage basin in the California Coast Ranges at a latitude of ~35.2° N and longitude of 119.9° W. Unlike Tulare and Buena Vista Lakes, which sample essentially the same precipitation source as Owens Lake and Searles Lake, the Carrizo Plain core will represent a heretofore unsampled geographic region between the Sierra Nevada and the Pacific Ocean.

26. LATE PLEISTOCENE PLUVIAL LAKES OF THE OWENS RIVER CASCADE, CALIFORNIA: THE RELATIVE ROLES OF TECTONIC AND CLIMATIC FORCING

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Pluvial lakes in the American West commonly occupy broad epeirogenic downwarps or narrower graben. These lakes flourished during the colder wetter climates of Pleistocene cold stages, only to shrink and often desiccate during warmer drier phases, most recently during Holocene time. Both tectonism and climate have thus influenced lake behavior. However, because tectonic activity becomes more apparent over longer timescales (10^3–10^7 years) whereas climate changes function over shorter timescales (10^1–10^5 years), it is usually assumed that climate is the main driver of these lakes and that changes in lake volume are driven by climate cycles, as deduced independently from ice-cores and marine archives. The tectonic setting of pluvial lakes, with certain exceptions, is usually considered invariant within these shorter timescales. From our continuing research at Owens Lake, however, we suggest that tectonic events operating over intermediate timescales (10^3–10^5 years) have had significant impacts on late Pleistocene events. The Owens River cascade, traditionally viewed as a climate-driven system within an established

tectonic framework, contains lakes and linkages that have been measurably changed by magmatic forcing and massive faulting within the past 10^3–10^5 years, and sometimes more rapidly. The evidence derives from deformed late Pleistocene shorelines and spillways that carried overflow waters southward to Searles Lake and beyond. Tectonic forcing within this time frame altered lake capacity, geochemistry, geomorphic processes, and sedimentation. Thus tectonism and climate are interactive drivers of lake change and the playing field on which climate exerts its influence is by no means stable.

27. LATE PREHISTORIC HUMAN IMPACTS ON MARINE FAUNA IN SOUTHERN CALIFORNIA: AN EXAMPLE FROM SAN NICOLAS ISLAND IN THE SOUTHERN CHANNEL ISLANDS

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Paleontological, archaeofaunal, and other scientific studies conducted during the past few decades show that ancient humans substantially impacted the ecology of many islands in the world. The recognition of these anthropogenic environments in the archaeological record has been masked over the years by the perceptions of some researchers that prehistoric Holocene environments contained an abundance of "pristine" faunal resources in which native peoples were the stewards of the land, and that animal extinctions and extirpations only occurred in the late historic period after Euro-American settlement of these islands. San Nicolas Island in the Channel Islands off the coast of southern California is no exception to this pattern. Human habitation on the island spans over 7,000 years of prehistory, which had a substantial impact on the environment. Data from several archaeological sites occupied during the last two thousand years of the late Holocene are examined with regard to overexploitation and resource depression of marine mammals, fish, and shellfish populations in near shore environments around the island. Results indicate that the prehistoric island inhabitants extirpated some marine mammals and substantially reduced the size of keystone mollusk species.

28. PREHISTORIC MARINE ADAPTATION AND POSSIBLE TRENDS OF OVEREXPLOITATION ON SAN NICOLAS ISLAND

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Archaeological evidence from San Nicolas Island suggests that the prehistoric inhabitants have had a long history of marine adaptation, beginning in the Middle Holocene. Since the first islanders, the people that occupied the island have been dependent on the local marine environment for survival. The archaeological record indicates that shellfish, Sea mammals, marine birds, and numerous species of fish were intensely exploited by the islanders. Applying optimal foraging theory as a base for interpreting the archaeological record from San Nicolas Island can help decipher possible trends of overexploitation of marine animals. Two archaeological sites will be intensely discussed to provide a synthesis for the relationships the islanders had with the marine environment.

29. FIXING THE LANDSCAPE IN PLACE: TAKIC PLACE NAMES AND NATURAL RESOURCES

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Native Americans filled the landscape with named places, including villages, natural features, gathering areas, and locations of important events. Place names used by several southern California tribes speaking dialects of the Takic languages are well known and provide numerous examples of naming places after natural resources found at those places. Names of economically useful plants are seen to dominate, along with names of animals and minerals. Examples given here are taken from the Acjachemen, Luiseño and Tongva tribes of south coastal California.

30. BURIED SITES ARCHAEOLOGY: LIFE BY THE LAKES IN LAGUNA CANYON DURING THE INTERMEDIATE AND LATE PREHISTORIC PERIODS

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People have been living by the lakes in Laguna Canyon, California for thousands of years, given the reliable availability of fresh water resources. The canyon is the only good travel route through the San Joaquin Hills, linking inland resource areas with the ocean. Recent construction exposed hearth features, artifact caches, and a dog burial. This paper will present in landscape context the results of excavations and scientific analyses of the data, including macro-botanical, geophysical, geomorphological, and radiocarbon studies. Issues of nomadism versus sedentism will be addressed. Additionally, the limitations of hand excavations in identifying deeply buried, low density, feature based sites will be discussed.

31. PREHISTORIC AND HISTORICAL ENVIRONMENT INTERACTIONS ALONG SANTA MONICA BAY, CALIFORNIA

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Human occupation along Santa Monica Bay dates back more than 8,000 years. Using archaeological, ethnographic, and archival data, we offer an overview of human interaction with the environment in this area from approximately 6,000 B.C. to A.D. 1940. For thousands of years, the area's Native American inhabitants followed a littoral adaptation to the Ballona wetlands and the surrounding coastal prairie that allowed the creation of a stable and conservative culture. The subtle changes in subsistence and settlement we have documented during this time were responses to regional climatic changes and the slowly evolving wetlands. With the arrival of the Spanish in the mid-1700s and their imposition of new technologies and economies on the landscape, the relationship between humans and the environment changed dramatically, making traditional Native American lifeways untenable. The later founding of ranchos and large land-grants in the area greatly altered the landscape and created new economies never seen before. Finally, the transition to the 20th Century began the slow, but steady growth of urbanization that we see now on the west side of Los Angeles.

32. UNDERSTANDING HUMAN RELATIONSHIPS WITH THE ENVIRONMENT THROUGH THE ANALYSIS OF ECONOMIC SYSTEMS DURING THE MIDDLE HOLOCENE IN THE NEWPORT BAY REGION

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The occurrence of cultural remains at CA-ORA-64, a Middle Holocene site located in Newport Bay, Orange County, California, raises many questions as to their origins and similarities with collections from other regions. This paper uses a micro and macro model to understand how socioeconomic trends represented by such artifacts also may provide information on how individuals living within the ORA-64 region interacted with their environment. This is done by addressing cultural remains and settlement patterns in association with climatic change. In addition, the model of hunter-gatherers as foragers and collectors defined by Mason et al. (1997) is used to understand the dynamics under which climate change and human use of resources affected continuous occupation or abandonment of sites, such as in the case of ORA-64.

33. TAPHONOMIC IMPLICATIONS OF DIFFERENTIAL PRESERVATION BETWEEN FRESHWATER FISHES

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The Sacramento perch, *Archoplites interruptus* (Centrarchidae), is the freshwater fish found in the greatest abundance in archaeological sites in the Central Valley of California. Native minnows

(Cyprinidae), not Sacramento perch, should be prominently represented, given the diversity of species. Due to this unexpected representation, I hypothesized that Sacramento perch bones may better resist decomposition in the soil and thus persist, while the bones of other freshwater species, such as minnows, decompose. To test this possibility, nine individual centrarchids and 20 individual cyprinids were buried in the soil for over seven years. The burial site was excavated, and the remaining bones were identified. Since vertebrae are among the most commonly preserved skeletal elements, particular emphasis was placed on their recovery. From comparison of recovered vertebrae and skull bones, it was found that the preservation of centrarchid elements was greater.

34. LONG-TERM ECOLOGY OF THE ICHTHYOFAUNA ADJACENT TO HUNTINGTON BEACH GENERATING STATION: A REVIEW OF ONCE THROUGH COOLING THEN AND NOW IN THE CONTEXT OF OCEANIC REGIME SHIFT

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Two intensive impingement studies at Huntington Beach Generating Station, separated by nearly 25 years, show a nearly seven-fold decrease in impinged abundance between 1978–1981 and 2003–2005 survey periods. Annual surveys since 1987 have documented continued decreases in impinged abundances through 2004 before increasing to near historic levels in 2005. Queenfish and white croaker comprised over 85% of the total impinged abundance. During the same period, average annual cooling water flows decreased from 476 million gallons in 1982 to 135 million gallons in 1991 before gradually increasing to 357 million gallons in 2005. Nearly annual otter trawl surveys show a similar decline in demersal fish abundance overall, although record densities were recorded in 1993. Overall annual trawl density was highly impacted by the abundance, or lack thereof, of white croaker. Similar studies have noted a decline in area fish stocks associated with the warm water regime that persisted from the late 1970's to the late 1990's. Lastly, the first site-specific ichthyoplankton survey of the area was conducted from 2003–2004, during which goby CIQ (*Clevlandia ios*, *Ilypnus gilberti*, and *Quietula y-cauda*) was the most abundant taxa, nearly doubling the density of the next most abundant group, unidentified anchovies (Engraulidae).

35. THE RECOVERING PACIFIC SARDINE (*SARDINOPS SAGAX*) POPULATION AS AN INDICATOR OF LINKAGE BETWEEN THE SOUTHERN CALIFORNIA BIGHT AND THE NORTH PACIFIC TRANSITION ZONE

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The recovery of the northern stock of sardine, *Sardinops sagax*, reminds us of how much biological and oceanographic research has been accomplished in the California Current while this stock was a virtual non-entity. It is the purpose of this study to update the ecology, oceanography and the human impacts on this species. Two sardine stocks, apparently isolated by spawning season and temperature, overlap in the Southern California Bight. The southern spawning stock, Cape San Lucas to Point Conception, spawns with the Panamic fauna in late summer: the northern spawning stock, Punta Eugenio to Alaska spawns in late winter-spring which is typical for the Oregonian fauna. By the end of the 1940's the northern stock was much reduced and virtually undetectable through the 1960s and 1970s while the southern stock apparently continued at about the same levels. Much research remains to be done to reincorporate this major player into its assemblages and the Northeast Pacific ecosystem.

36. CHLORINATED HYDROCARBONS IN PELAGIC FORAGE FISHES AND SQUID OF THE SOUTHERN CALIFORNIA BIGHT

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Large quantities of dichlorodiphenyltrichloroethane (total DDT) and polychlorinated biphenyls (total PCB) have been historically discharged to the southern California Bight (SCB). While these contaminants have bioaccumulated in sediment-associated fishes, little data exists on concentrations of these compounds in pelagic forage species that are the likely food source to larger predatory mammals and birds. The goal of this study was to assess the extent and magnitude of total DDT and total PCB bioaccumulation in the four major pelagic species of the SCB: Pacific sardine (*Sardinops sagax*), Pacific chub mackerel (*Scomber japonicus*), northern anchovy (*Engraulis mordax*), and California market squid (*Loligo opalescens*). A total of 99 composite samples were collected from commercial landing docks along the southern California coast from July 2003 to February 2004. Whole fish were homogenized and analyzed for total DDT (ortho- and para-isomers of DDT, DDE, and DDD) and 41 PCB congeners. Virtually all of the samples of Pacific sardine, northern anchovy, and Pacific chub mackerel had detectable levels of total DDT. Only 50% of the California market squid samples had detectable total DDT. Northern anchovy had the highest tDDT concentrations (60 ± 38 µg/kg wet weight [ww]), followed by Pacific chub mackerel (41 ± 40 µg/kg ww), Pacific sardine (34 ± 29 µg/kg ww), and California market squid (0.8 ± 1.2 µg/kg ww). In general, concentrations were highest in the central SCB. An estimated 99% of northern anchovy, 83% of Pacific sardine, 33% of Pacific chub mackerel, and 0% of California market squid landings exceeded wildlife risk screening values for total DDT. Virtually none of the landings were estimated to exceed wildlife risk screening values for PCBs.

37. VARIATION IN DDT/PCB CONCENTRATIONS IN WHITE CROAKER (*GENYONEMUS LINIATUS*) IN THE SOUTHERN CALIFORNIA BIGHT: INFLUENES OF LOCATION, BODY SIZE, AND LIPID CONTENT

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White croaker (*Genyonemus liniatus*) has received much attention in the Southern California Bight due to elevated PCB/DDT concentrations in their tissues in some areas within the bight. This contamination has resulted in fish consumption advisories for this species, particularly on the Palos Verdes Shelf and southern Santa Monica Bay. Few studies have examined in detail the spatial variation in PCB/DDT concentrations in white croaker, and no broad scale surveys have been conducted since 1987. We report results from a survey of contaminants in fish that examined contaminant concentrations in individual fish over a broad area of the bight. While the survey collected 23 species of fish, our discussion will be limited to results from white croaker, the species for which the most spatially comprehensive data were collected. Individual-level analyses allows for detailed evaluation of the effects of between location and between individual differences on PCB/DDT concentrations. Results of this analysis suggest that while location strongly influences contamination levels, individual differences, particularly lipid concentration, also play a role. The influence of factors such as lipid concentration, body size, and individual movement patterns may serve to either mask or falsely create differences between locations if not carefully evaluated, making the interpretation of contaminant data that is based on composites difficult. We argue that to most effectively evaluate spatial and temporal trends in contaminant concentrations, it is critical to analyze individuals and to record individual characteristics (size, lipid content, gender, etc) so that differences between locations and time-points can be distinguished from differences in these characteristics.

38. CONDITION OF DEMERSAL FISH AND INVERTEBRATE ASSEMBLAGES IN THE SOUTHERN CALIFORNIA BIGHT IN 2003

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A regional survey of the Southern California Bight in 2003 assessed the condition of demersal fish and invertebrate populations and assemblages, bioaccumulation in pelagic forage fishes, and the distribution of marine debris. The 210 stations at 2-476 m depth were sampled using 7.6-m wide otter trawls from Point Conception to San Diego and at the Channel Islands yielded 142 species of fish and 308 species of invertebrates. Fish and invertebrate assemblages were associated with bathymetric life zones, with islands differing slightly from the mainland. Population attributes varied most by depth, being lowest in bays or inner shelf and highest at middle and outer shelf zones. Compared to the 1970s, demersal fish and invertebrate populations and assemblages were relatively healthy in 2003. A fish biointegrity index assessment showed 96% of the area to be normal. Fish populations had background levels of anomalies and a baseline was established for fish ectoparasites. Anthropogenic debris increased from 14 to 25% of the shelf area since 1994. DDT was prevalent in pelagic forage fishes collected in the Bight in association with this survey. During the past regional surveys, fish and invertebrate assemblages have changed in time in response to the prevailing ocean climate during the survey. Depth displacement patterns in fish foraging guilds described during a cold regime in the 1970s were most similar to those of 2003 (also cold), least in 1998 (very warm), and intermediate in 1994 (warm). Future assessments must distinguish local anthropogenic effects from responses to naturally changing ocean conditions.

39. THE CONDITION OF BENTHIC INVERTEBRATE COMMUNITIES IN THE SOUTHERN CALIFORNIA BIGHT

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Benthic community condition in the Southern California Bight (SCB) was assessed for the Bight'03 Regional Monitoring Survey. In summer 2003, 351 benthic samples were collected in the SCB using a random tessellation stratified (RTS) design stratified on habitats and potential sources of pollution. Samples were collected with 0.1 m^2 Van Veen grabs and sieved through 1 mm mesh screens. Organisms retained on screens were identified and counted. The species abundances were used to assess community condition for each sample using the Benthic Response Index (BRI) on the mainland shelf and the SQO26 index in bays, harbors, and estuaries. Where possible, benthic conditions in 2003 were compared with conditions during similar surveys in 1994 and 1998. Overall, SCB benthos were in good condition during 2003, with 98.4% of the area in reference condition or only deviating marginally. There was no evidence of disturbance on the island shelf, near small POTWs, and virtually none on the mainland shelf. Areas near large POTWs did not differ substantially from other areas at similar depths on the coastal mainland shelf. Benthos in bays and estuaries were more frequently disturbed with altered benthic communities occupying nearly 13% of the area. Altered communities occurred most frequently in estuaries and marinas. The condition of benthos on the SCB mainland shelf is not changing rapidly with 1.6 to 2.8% of the coastal shelf remaining in poor benthic condition over the 9-year time span.

40. CHARACTERISTICS OF BENTHIC MACROFAUNA OF THE SOUTHERN CALIFORNIA BIGHT

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During summer and fall of three regional surveys between 1994 and 2003, sediments from eight Southern California Bight (SCB) habitats were collected with a 0.1 m^2 Van Veen grab, sieved through

a 1 mm mesh screen and analyzed for community characteristics. Among 977 samples, 413 were determined to be from areas that could be potentially contaminated. Among the remainder (564), habitat means were calculated for five community measures: total abundance, number of taxa, Shannon-Wiener diversity, evenness, and dominance. For habitats where data were available from multiple surveys, community measure means were also compared among the surveys.

Mean abundances of benthic macrofauna decreased with increasing distance from land. Taxa counts were highest on the shelf and were lower in both shallower and deeper habitats. Patterns for diversity and dominance mirrored taxa counts, but eveness values increased slightly with depth. When compared among surveys, community patterns were mostly stable and did not significantly change over time. The exception was the island shelf, where significant increases in diversity, evenness and dominance occurred from 1998 to 2003. Annelid abundances dominated all .benthic habitats (49%–63%). Very low proportions of these were oligochaetes, except in estuaries where they represented about one-quarter of all annelids collected. Mollusks and arthropods were typically ranked either second or third in abundance behind annelids except on the middle and outer shelves where ophiuroids ranked above mollusks. Data from this survey can be used as a baseline for all SCB monitoring programs.

41. MARINE ECOLOGICAL MONITORING STUDIES AT CRYSTAL COVE STATE PARK TO DETERMINE IMPACTS FROM A COASTAL DEVELOPMENT PROJECT

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Development of the marine terrace along the Newport Coast above Crystal Cove State Park was initiated in early 1990's. During Phase IV of this development project quantitative ecological field studies were carried out from December 1999 to May 2006 to evaluate possible effects of storm water runoff on intertidal and shallow subtidal marine invertebrates and algae. Study sites were adjacent to the mouths of three watershed drainages. At each site, photographs were taken before the start of the rainfall season and at a series of time periods after rainfall events or at the end of the rainfall season. Images were reviewed using Scion imaging software to quantify percent cover for selected species. Surf grass samples, *Phyllospadix torreyi*, were also collected in conjunction with this sampling and analyzed for percent cover of algal epiphytes and animal epibionts on the blades. Both multiple regression and BACI techniques were used to analyze the data. Results from template quadrat studies indicate clearly that lowered salinities and constituents in storm runoff at the rocky intertidal stations had no evident or statistically significant effects on percent cover of the indicator species *Anthopleura elegantissima* and *Mytilus californianus*. The same was true for density (number of individuals per 1000 sq cm) of *M. californianus*. Furthermore, the results of all the ecological studies indicate clearly that there were no evident or significant effects on the marine organisms of the Newport Coast due to runoff from storms.

42. MODIS IMAGERY AS A TOOL FOR SYNOPTIC WATER QUALITY ASSESSMENTS IN SOUTHERN CALIFORNIA COASTAL OCEAN

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The dynamics of rainstorm plumes in the coastal waters of southern California was studied during the Bight'03 Regional Water Quality Program surveys in February 2004 and February-March 2005. Measurements of surface salinity, concentrations of total suspended solids (TSS), colored dissolved organic matter (CDOM), and bacterial counts collected from research vessels were compared to simultaneously collected MODIS-Aqua satellite imagery. The spectra of normalized water-leaving radiation (nLw) were different in plumes and ambient ocean waters, enabling plumes discrimination and

plume area size assessments from remotely-sensed data. The accuracy of plume area assessments from satellite imagery was not high, seemingly because of inexactitude in satellite data processing. In particular, the expected correlation between remotely-sensed CDOM absorption estimated by Lee's quasi-analytical algorithm (QAA) and CDOM concentrations in the water column was often obscured by external factors including wind-driven sea state and phytoplankton blooms. Nevertheless, satellite imagery is a useful tool for the estimation of the extent of polluted plumes, which is hardly achievable by contact methods.

43. SETTING UP A WATER QUALITY MONITORING NETWORK ALONG THE CALIFORNIA COASTLINE

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California State University (CSU) has established the Coastal Observation, Research and Education (CICORE) observatory. The purpose of this project is to gain a better understanding of how natural processes and human activities impact the coastal environment and to communicate this information to the scientific community, regional agencies, and the public. CICORE consists of eight CSU campuses. Each campus has set up or is in the process of setting up sites along the California coastline. Southern California Marine Institute (SCMI), through CSU Long Beach, is the CICORE contributor in the greater Los Angeles area. SCMI, has established a site at the terminus of the Los Angeles River and at Fish Harbor, in Los Angeles Harbor. Standard water quality measurements are collected and transmitted at six-minute intervals at a depth of 1.5 m from the surface. These measurements include pH, turbidity, temperature, chlorophyll *a* concentrations, salinity, and dissolved oxygen. This data is readily available in near real-time on the web (http://www.icontrol.ws/SCMI). Data presented here show the value of high frequency water quality monitoring in understanding the natural variability as well as the impacts detected from storm water and pollution events. The future goals of this project are to include weather stations at each site, to increase the number of sites to get a better overall picture of the measured parameters and to integrate these data with other regional and regulatory efforts.

44. CONTRASTING BASALTIC ERUPTION STYLES OBSERVED AT RED CONES, EASTERN SIERRA NEVADA

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Red Cones are a nested pair of basaltic cinder cones located approximately 10 km SW of Mammoth Mountain, in the eastern Sierra Nevada of California. Basaltic eruptions about 5,000 years began with violent Strombolian eruptions that formed the cinder cone pair followed by effusive eruptions of lava. Lava flows range from 0.1 to 2 m in thickness, and exhibit both àa and pahoehoe textures, as well as well preserved flow levees and lava tubes. The Red Cones eruptions were dominantly effusive, with variably fluid lava flows accounting for 90% of the total dense rock erupted material (1 cubic km). Cinder and lavas range narrowly in crystal content from 5 to 8 vol%, and contains plagioclase, olivine, clinopyroxene, and magnetite with traces of ilmenite. The finale of the eruption from the north cone was characterized by alternating explosive and effusive phases marked by spatter mounds enclosing the vent region, whereas the south cone shows no evidence of explosive activity at the eruptions end. In order to investigate the role that magma composition plays in this commonly observed temporal sequence of changing eruption styles as noted at other cinder cones, we are combining detailed geologic mapping with electron microbeam analysis of olivine, plagioclase, and Fe-Ti oxide phenocrysts from both cinder and lava products of Red Cones.

45. PETROLOGIC CONSTRAINTS ON ERUPTION TRIGGERING AT MAMMOTH MOUNTAIN, CALIFORNIA

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In this study, we present results that constrain the timescales of eruption triggering and magma ascent at Mammoth Mountain, a trachydacitic to rhyodacitic dome cluster located on the southwestern rim of Long Valley Caldera in eastern California. Field-based observations and analytical evidence show that many Mammoth Mountain dome magmas were repeatedly intruded by batches of mafic magma prior to eruption based on the presence of mafic enclaves, derivative xenocrysts, and disquilibria textures. Electron microprobe analysis touching Fe-Ti oxide pairs analyzed from 7 domes and 1 lava flow show a range in temperatures from 748 to 945 C for core compositions, which are taken to represent a pre-mixing temperature of the magma, and 862 to 989 C for rim compositions, which are interpreted to represent a post-mixing temperature. Diffusion profiles in Fe-Ti oxides suggest that mixing preceded eruptions of trachydacites over timescales of ranging from 1 month to 2 years.

46. U-PB DATING OF ZIRCON CRYSTALLIZATION IN THE HOT CREEK RHYOLITE, LONG VALLEY CALDERA, CALIFORNIA: NO CRYSTAL MEMORY OF BISHOP TUFF MAGMA

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The 760 ka eruption of Long Valley caldera produced a 17 × 32 km collapse depression and ejected more than 600 km^3 of rhyolite magma that is preserved as the regionally extensive Bishop Tuff. Since collapse, more than 100 km^3 of rhyolite lava has erupted onto the caldera floor. The origin and significance of these rhyolites are unclear: At the extremes, they represent tapping of residual Bishop magma or represent new rhyolite that is essentially unrelated to the caldera-forming magma. In order to determine whether post-caldera rhyolites at Long Valley retain a "memory" of crystallization in the Bishop magma chamber, we dated zircons from the Hot Creek rhyolite lava flow, which erupted at 329±3 ka (sanidine Ar/Ar age; Heumann, 1999). High-resolution ion microprobe ^{238}U-^{206}Pb dating of single Hot Creek zircons (n=11) yields a common Pb- and ^{230}Th-corrected weighted mean age of 311±22 ka (1□, MSWD=1.4). The results indicate that rhyolites erupted around ~330 ka do not contain a crystal "memory" of Bishop magma, which in turn suggests the generation and differentiation of new post-collapse rhyolite, or that residual Bishop magma was re-heated to superliquidus conditions. The close overlap between crystallization and eruption ages suggests that the Hot Creek rhyolite was only briefly stored before eruption. In contrast, ^{238}U-^{230}Th dating of zircons and major minerals from a ~0.6 ka post-collapse rhyolite suggests storage on the order of 10^5 years prior to eruption (Reid et al., 1997).

47. NEOGENE ALKALINE/SUBALKALINE VOLCANISM IN THE EASTERN MOJAVE PROVINCE

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Neogene volcanism in the eastern Mojave Desert has resulted in the emplacement of a suite of related subalkaline to alkaline rocks. The earliest event began at approximately 13.0 Ma and resulted in the emplacement of hypabyssal sills of rhyolitic to trachydacitic composition at Mesquite Pass. This was followed one to two million years later by flows of trachyandesite (pyroxene andesite), 15 km to the west in the Halloran Hills. Following a hiatus of three to five million years, renewed volcanic activity in the southern Halloran Hills and Cima volcanic field resulted in trachybasalts (hawaiites) and basaltic trachyandesites (mugearites). This phase of volcanism continues to the Present. Our study analyzed over 130 rock samples for 21 major, minor and trace elements. The data define a trend of high K_2O+Na_2O volcanic rocks showing minimal decease in alkalis with decreasing silica content over time. Trace element analyses of the andesites and basalts indicates continental crust played has played an important role in their genesis.

We suggest that Neogene volcanism began during the initial stages of late Miocene detachment and has continued to Recent time, as upwelling asthenosphere has occupied the void created by the thinning lithosphere. The compositional variation in the related members of the rock suite reflect progressively deeper melting, from shallow crustal rhyolite and trachydacite to lower crustal pyroxene andesite to asthenospheric mantle basalts. Assuming a stationary heat source, Neogene volcanism requires the eastern

Mojave to have undergone clockwise rotation at an average rate of 5 mm/year. This rotation appears to consist of two distinct events; a period of nearly east-west motion from 10 to 13 Ma, related to detachment, and a younger north-south directed event from the Present to 7 Ma, a consequence of dextral shear.

48. VOLCANIC PETROLOGY, GEOCHEMISTRY AND STRATIGRAPHY OF THE GRANDE SOUFRIERE HILLS VOLCANO, DOMINICA, WEST INDIES

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Dominica, located in the center of the Lesser Antilles island arc, has eight potentially active volcanoes. The Grande Soufriere Hills volcanic center, one of the least-studied centers on the island, has not experienced an eruption for approximately 10,000 years. Stratigraphic studies suggest that this center is dominated by eruptions of matrix-supported *block and ash flow* and *surge deposits* generated by dome collapse (*Pelean-style eruptions*). Volcanic rocks from this center are all *porphyritic andesites* characteristic of *subduction zone magmas*. Plagioclase crystals many displaying oscillatory zoning or inclusion-rich cores are the dominant *phenocrysts*. *Mafic phenocrysts* include hornblende, which varies from unaltered to strongly oxidized and pseudomorphed, together with lesser amounts of hypersthene, augite and magnetite. The andesites erupted by the Grande Soufriere Hills range from 58–63 wt% SiO_2 and show decreasing trends of Al_2O_3, FeO, MgO, CaO, TiO_2, Sr, V, and Sc and increasing trends of Na_2O, K_2O, Ba, Rb, and Zr with increasing silica. These geochemical variations can be explained by *fractionation* of *phenocryst* phases from a parent magma of *basaltic* composition.

49. PALEOMAGNETIC EVIDENCE FOR TIMESCALES OF MULTI-VENT BASALTIC ERUPTIONS IN BIG PINE VOLCANIC FIELD, CALIFORNIA

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Previous research indicates that basaltic volcanic fields are monogenetic; that is, they undergo a single eruption that lasts no more than about ten years. Alternatively, some workers have suggested that certain basaltic volcanic fields are polygenetic, in that they erupt multiple times over hundreds to thousands of years. Identifying volcanic areas as either polygenetic or monogenetic is important for hazard analysis since polygenetic volcanoes, being longer-lived, may pose a greater hazard to humans and to the environment than monogenetic volcanoes. A combination of reconnaissance mapping and paleomagnetic analysis are used to determine whether Big Pine Volcanic Field (BPVF), Owens Valley, California is monogenetic (short-lived) or polygenetic (long-lived). The BPVF is composed of 22 cinder cones and their associated lava flows. One hundred and five oriented samples were collected for paleomagnetic analysis from flows spanning 8 kilometers across the BPVF. Step-wise AF demagnetization procedures showed that all samples record normal polarity, consistent with K-Ar dates for the Taboose Creek volcanic center of 130 ka. Past studies of the BPVF imply that some flow units may be as old as 1 Ma (Connor and Conway, 2000); however, samples of that age should record reversed polarity. Characteristic remanent directions were calculated using principal component analysis for each sample. Site-mean directions from 21 sites cluster tightly, suggesting that sampled flows were erupted over a very short (<1000 years; monogenetic) time period and did not record significant changes in the earth's magnetic field. VGP calculations for site mean directions will help confirm this interpretation.

50. CONSTRAINING THE RATE AND STYLE OF MAGMA ASCENT AT MAMMOTH MOUNTAIN, EASTERN CALIFORNIA

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Constraining the timescales and styles of magma ascent was performed by investigating the thickness, mineralogy, and texture of amphibole and biotite reaction rims found in Mammoth Mountain domes and

lava flows through Scanning Electron Microscopy (SEM). Hornblende phenocrysts are typically angular, and surrounded by reaction rims composed of plagioclase, pyroxene and Fe-Ti oxides. Though all samples are similar in mineralogy, rim microlites range in size from 2 to 23 um and rim thicknesses range from 3–275 um in diameter, indicating highly variable eruption pathways for magmas erupted over Mammoth's history. Rim textures of samples taken from Dragon's Back, located on the southwestern periphery of the dome complex, are texturally zoned, where the rim adjacent to groundmass is coarser relative to rim microlites adjacent to the phenocryst. This indicates that the Dragon's Back magma body likely stalled in the shallow crust at depths of ~5 km and ~1 km during its ascent to the surface prior to eruption. Rim textures of samples taken from elsewhere on the Mammoth edifice are homogenous with respect to rim microlite grain size. Aspect ratios of the reaction rim microlites from all samples range from 0.9 to 5.9 with a maximum crystal length of 12.7 um, suggesting that ascending magmas do not rise to the surface at a constant rate, but rather have a tendency to stall en route at shallow depth (~1 km) for 5–10 days prior to extrusion.

51. BASALTIC VOLCANISM AND VOLCANIC HAZARDS AT BIG PINE VOLCANIC FIELD, INYO COUNTY, CALIFORNIA

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The Quaternary Big Pine Volcanic Field (BPVF) located in the Owens Valley eastern California; is a considerable volcanic hazard. BPVF contains approximately 28 individual vents forming N-S trending lineaments on both sides of the Owens Valley. Except for a single rhyolitic dome in the center of the field the primary eruption product is basalt issued from cinder cones and fissure vents. Along the west margin of the valley, cinder cones, spatter and fissure vents are aligned along fault scarps. Vents along the eastern margin of the valley comprise cinder cones and their associated lava flows. Approximately 25 total basaltic lava flows issued from volcanic vents at BPVF, with an average flow length of ~7 kilometers; the longest lava flow is approximately 9 kilometers in length. Our preliminary field mapping establishes that individual vent clusters may be associated with multiple lava flows with distinct mineralogy. At a vent cluster in the western BPVF, pahoehoe lava is restricted to within about 1.5 km of its fissure vent. This pahoehoe flow transitions to aa flow at about 1.5 km from the vent, suggesting a decrease in magmatic discharge rate from the vent during a Hawaiian style eruption and, in turn, a decreasing volumetric flow rate of lava over the course of the eruption. In contrast, a lava sequence from a cinder cone on the eastern portion of BPVF comprises thin (<0.5 m) pahoehoe flows capped by thicker (1–2 m) aa flows, suggesting increasing magmatic discharge over the course of this Strombolian eruption.

52. FIELD RELATIONSHIPS AND MINERAL ABUNDANCES OF THE ~5000 YEAR OLD BASALTS ERUPTED FROM RED CONES VOLCANOES, CALIFORNIA

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Red Cones volcanoes, located ~10 km SW of Mammoth Mountain, in the eastern Sierra Nevada of California, erupted approximately 5,000 years ago. Cinder and lavas range narrowly in crystal content from 5 to 8 vol%, and contains plagioclase, olivine, clinopyroxene, and magnetite with traces of ilmenite. Combining field mapping with a mineral abundance investigation, we developed the following model of eruption at Red Cones. Stage 1 is characterized by the initiation of eruption from the southern cone with effusion of lavas fed by a rising basaltic dike. These lavas underlie both cinder cones and are thickest beneath the south Red Cone. Stage 2 activity includes Strombolian style eruptions at both cones, where eruptions from the southern crater is more energetic and voluminous based on its greater elevation and the presence of a more extensive and coarser-grained basaltic bomb field on the S. Red Cone crater rim. Stage 3 of the eruption is characterized by magma erupting from both cones, resulting in the breaching of both cones on their SW crater walls and the emplacement of thin, sheet-like lavas with well-developed levee walls, and tendency to develop lava lakes (pools). Over time, eruption rate declines at both cones resulting in emplacement of aa lava flows from the south cone and agglutinate spatter flows from the north cone.

53. RHYOLITE MAGMATISM IN THE BIG PINE VOLCANIC FIELD, EASTERN CALIFORNIA

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The Quaternary Big Pine volcanic field (BPVF), Owens Valley, eastern California, is primarily basaltic volcanic field, containing approximately 30 cinder cone volcanoes and associated lava flows, and a single rhyolite coulee erupted at ~ 1 Ma. At nearby Coso volcanic field, an abundance of rhyolite relative to basalt suggests crustal melting by mafic magmas stored in mid to upper crustal reservoirs, whereas the paucity of rhyolite relative to basalt at BPVF suggests only brief crustal residence of ascending mafic magmas (Mordick and Glazner, 2006). In order to determine the origin of rhyolite magmatism at BPVF, we have undertaken a detailed petrologic study of the Fish Spring rhyolite, located in west-central portion of BPVF. Fish Springs coulee is approximately 1.8 × 0.8 km in area, and represents effusion of at least 0.7 km^3 of magma. Discontinuous tuff deposits occur on the southern portion of the coulee, which may represent an early explosive phase of the eruption. The outer portions of the coulee are composed of autobrecciated and felsitic rhyolite, and internal portions exposed by quarrying are flow banded and pumiceous. The Fish Springs rhyolite is crystal poor (~1%) and perlitic, containing small (<0.5 mm) phenocrysts of plagioclase, quartz, orthopyroxene, clinopyroxene, biotite, hornblende, and zircon, as well as apparent xenoliths of basalt. The crystal-poor nature may reflect near-liquidus temperatures or filter pressing of a crystal-rich source. The ultimate mechanism for rhyolite generation at BPVF may be crustal melting or extreme fractional crystallization of mantle-derived magma.

54. CENOZOIC VOLCANISM ON THE DARWIN PLATEAU

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The Darwin Plateau lies near the southern end of the Inyo Mountains, the Panamint Valley to the east and the Owens Valley to the west. A series of basaltic flows were emplaced on the plateau from 8 Ma to 4 Ma. Basalts of the Coso field (2 Ma-Pres.) lie 50 km to the southwest and the Ricardo volcanics (10–8 Ma) 100 km to the south-southwest. Sixty basalt samples from the Darwin Plateau were collected and analyzed for major, minor and trace elements. Those analyses were compared to others for the Coso and Ricardo volcanics.

The Darwin basalts show considerable variation in composition. The majority are olivine tholeiites, in marked contrast to the quartz-normative tholeiites of the Ricardo volcanics and the nepheline normative alkali basalts of the Coso field. Petrographic examination reveals that Darwin basalts often contain altered olivine phenocrysts with reaction rims of iddingsite. Basalts from the Ricardo field have only pseudomorphs after olivine while phenocrysts of unaltered olivine are common in the Coso volcanics. The Darwin field is also unusual in that flows of both alkaline and subalkaline composition have been documented, suggesting changes in either depth of melting or oxygen fugacity.

The compositional variation for Owens Valley basalts may reflect the changing tectonics of the valley. Early *Q* normative tholeiites (Ricardo - 10 Ma) were emplaced during range-front normal faulting while the younger basalts of the Coso field (<2 Ma) are related to dextral shear. The Darwin basalts (8–4 Ma) represent a transitional phase with subalkaline flows perhaps related to normal faulting and alkaline flows related to right-slip.

55. PHYSICAL AND CHEMICAL CHARACTERISTICS OF VOLCANIC HOTSPRINGS AT WOTTEN WAVEN, DOMINICA, LESSER ANTILLES

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The island of Dominica located at the center of the Lesser Antilles volcanic island arc contains 8 potentially active volcanoes giving it one of the highest concentrations of active volcanoes in the world. Evidence for volcanic activity, since European arrival on Dominica in the 17th century include two phreatic eruptions and 17 volcano-seismic crises. In addition the island has over 30 volcanic-related hot

springs. In 2003 a sampling program of these hot springs was initiated with the most recent data collected in July 2006 to provide a baseline for volcanic monitoring. This presentation will provide a detailed study of the temperature, pH, chemistry and geothermometry of 15 hot springs located within the Wotten Waven caldera that last erupted around 1000 years ago. Initial results show that the Wotten Waven springs exhibit temperatures of between 48° and 102°C, and have an average pH of 3.5. Over the period of the study many of the springs have shown small but measurable increases in temperature and significant changes in water chemistry, e.g. increases in U and Th and decreases in transition metals. Silica geothermometry on spring water give fluid source temperatures of between 58° and 109°C. Preliminary conclusions suggest considerable water-rock exchange with seawater playing a significant role in the hydrothermal system.

56. ERUPTIVE HISTORY OF SOUFRIERE VOLCANO, ST. VINCENT AS ILLUSTRATED BY THREE PYROCLASTIC SEQUENCES

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Studies on three *pyroclastic* sequences from Soufriere Volcano, St. Vincent have revealed significant differences in eruptive style over time. 1) During the Late Pleistocene, *Plinian*, *Vulcanian* and *Strombolian* eruptions produced deposits, which range in thickness from 50 m in the northeast to 2 m in the south and cover about 55% of the island; 2) Stratigraphic studies of the 1902 eruption indicate an initial sequence of surges and flows overlying a well-developed paleosol, followed by many thin fall beds. Both fall and flow deposits are composed of a combination of *juvenile clasts*, *lithic fragments*, crystals, and *accretionary lapilli*. Although the abundance of *accretionary lapilli* in most deposits indicates a significant hydrologic component throughout the eruption, the variations in their amounts between the different beds suggest that the water-magma contact fluctuated significantly during the eruption; 3) Deposits from the he 1979 eruption are dominantly fall deposits with abundant *accretionary lapilli*, and minor flow deposits. The former can be subdivided into a lower blue-grey (explosive events of April 13 and 14) and an upper yellowish brown unit (explosive events April 17–26), and generally show a bimodal grain-size distribution with the secondary coarse mode produced by the abundant *accretionary lapilli*. The presence of *accretionary lapilli* together with the fine-grained nature of the deposits all suggest that the eruptions were *phreatomagmatic* in origin. The apparent absence of *juvenile fragments* in the lower *pyroclastic flow* suggests that the initial eruptions represented the explosive shattering of the 1971 dome.

57. IMMIGRATION IN THE OCEAN: STATOLITHS AS LARVAL PASSPORTS

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To test hypotheses about larval dispersal and how it impacts population dynamics, an effective means of identifying the sources of recruits to populations must be developed. Trace elements in calcified structures like statoliths have the potential to naturally tag marine larvae with a characteristic chemical composition at their birthplace and could be used to determine sources of recruits. However, this tool requires that there be consistent differences of trace elements in statoliths among populations at spatial scales relevant to larval dispersal. To estimate the spatial and temporal variability of trace elements in larval statoliths throughout Kellet's Whelk's (*Kelletia kelletii*) range we collected egg-masses at 22 sites from Monterey, California, USA to Isla San Roque, Baja California, Mexico during the summers of 2004 and 2005. Here we present evidence that trace elements (Mg, Sr, Ba, Ce and Pb) in larval statoliths of *K. kelletii* vary on a regional scale (MANOVA, $p < 0.0001$) and the differences among regions are consistent between years. Linear discriminant-function analysis (DFA) correctly classified 40% of statoliths to their natal site ($n=22$) and 70% of statoliths to their natal region ($n=3$). The results suggest that statoliths can be used to assign recruits to their source on a regional scale. Thus, statoliths could be used as to test hypotheses about exchange of larvae across the well-known biogeographic boundary, Pt. Conception, CA and between the California, USA and Baja California, Mexico.

58. GLOBAL POPULATION STRUCTURE OF THE TOPE (*GALEORHINUS GALEUS*), AS INFERRED BY MITOCHONDRIAL CONTROL REGION SEQUENCE DATA

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The tope, *Galeorhinus galeus*, is a medium sized member of the order Carcharhiniformes (Triakidae), currently distributed globally in temperate waters. Global populations of *G. galeus* are considered to be in decline due to the exploitation of shark fisheries over the past 100 years. Little is known of the northeastern Pacific population of *G. galeus*, and recent observations off the California coast indicate an increase in numbers. To determine the genetic structure of northeastern Pacific *G. galeus* populations, and the levels of gene flow among globally distributed populations, samples (n = 96) were collected and analyzed from five geographically dispersed populations (Argentina, Australia, California, South America, and the U.K.). A 1006-bp section of the 1068-bp mitochondrial control region revealed 33 polymorphic sites with 20 transitions, 11 transversions, and 2 deletions producing 28 haplotypes. Haplotypes were unique to their geographic location with only one haplotype shared between Africa and Australia. Overall, populations demonstrated high levels of haplotype diversity (0.9004 +/− 0.0172), and low levels of nucleotide diversity (0.0065520 +/− 0.003458). Estimated migration rates were low (M = 0.05–0.97), resulting in significant genetic structure (F_{ST} = 0.27151 and Φ_{ST} =0.85642; $P < 0.001$) among populations. Due to an apparent lack of migration across ocean basins, populations of *G. galeus* appear to be isolated from each other with little to no gene flow occurring among populations. As a consequence of this isolation, increasing numbers of *G. galeus* in the northeastern Pacific can be best explained by local recruitment and not input from foreign populations.

59. REPRODUCTIVE LONGEVITY IN THE POLYCHAETOUS ANNELID *DINOPHILUS GYROCILIATUS*

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The polychaetous annelid *Dinophilus gyrociliatus* is a minute worm measuring from 0.5 to 1.5 mm in length and reaches sexual maturity in 7–10 days. Polychaetes reproduce in a variety of ways, but this species is unique in its method. The hermaphroditic worm lays two sizes of eggs in a capsule. The larger eggs, numbering from 1 to 12, become females, and the smaller eggs, numbering 1–3, become males. While still in the capsule, the male pierces the female to transfer its sperm which initiates the development of gonads. The male then dies. The female, now a hermaphrodite, escapes from the capsule and begins feeding. Worms were fed a suspension of commercial fish flakes. The objective of this research was to determine the reproductive longevity of this species. Twenty worms were used in this experiment. Eggs were laid in capsules five days after emergence and every two to five days thereafter for up to eleven times. Beginning with the third egg laying, both male and female eggs were also deposited without a protective capsule. These eggs did not develop. It was theorized that developmental failure was the result of inadequate food, inability of forming capsules, or insufficient sperm.

60. THE MECHANISM OF MALE CHOICE IN THE SEMELPAROUS POLYCHAETE *NEANTHES ACUMINATA*

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Neanthes acuminata [*N. arenaceodentata* and *N. caudata*] is a semelparous polychaete found in brackish and marine waters. Individuals construct mucous-lined burrows in shallow sandy sediments. Male and female individuals form monogamous pairs and occupy the same burrow to reproduce. The female then dies 2–3 days after shedding her eggs. The male fertilizes the eggs and undertakes sole parental care, using undulating body movements to oxygenate the eggs. The juveniles leave the tube at 21 days and begin to feed. After this time, the male is ready to reproduce again. Although there has been extensive research into the aggression and behavior of this species, this study focused on mate choice in relation to dominance and

previous reproductive encounters. Dominant males were found to be favored over subordinate males; experienced males, those that have successfully produced a brood, were found to be preferred over inexperienced males. Furthermore, experienced males were preferred over all other variables. Further experiments were carried out to determine if the "scent of experience" had a chemical basis. It was found using conditioned water that males who previously failed to attract a female could be made into winners by placing the loser into water conditioned by an egg-caring male. This work has posed further questions regarding the chemical signalling involved in aquatic environments and has opened up research opportunities into the rare occurrence of mate choice in a marine invertebrate.

61. TO SETTLE OR NOT TO SETTLE: SEASONAL SETTLEMENT OF OYSTER LARVAE, *OSTREA CONCHAPHILA*, IN TWO SOUTHERN CALIFORNIA ESTUARIES

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Declines in populations of the native west coast oyster, *Ostrea conchaphila*, Carpenter, 1857, have piqued recent interest in restoring its populations. Since local population persistence is influenced by larval settlement, information about the magnitude and timing of settlement will provide valuable contributions to restoration efforts. Previous literature based on an anomalous open coast population in La Jolla, CA found that settlement of *O. conchaphila* occurred once seawater reached 16°C and ceased once temperatures fell below that point. To observe variation larval settlement over seasons within the more common estuarine habitat in southern California, we placed ceramic tiles in two locations within Upper Newport Bay, Newport, CA and in two locations within Aqua Hedionda Lagoon, Carlsbad, CA. Temperature was monitored continually at each site throughout the duration of the experiment. Tiles were collected and oyster settlers counted during spring tides to pinpoint peaks in settlement. There was significant seasonal variation in settlement, with the significantly greater settlement occurring during June 2005 and June 2006 within both estuaries. Contrary to previous findings, we did not observe a universal temperature trigger predicting the initiation and termination of oyster settlement, nor any significant correlations linking water temperature, salinity, or tidal height with peaks in settlement.

62. MEDIAL RED MUSCLE DEVELOPMENT IN THE YELLOWFIN TUNA (*THUNNUS ALBACARES*)

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Fishes use myoglobin-rich, slow-twitch, oxidative (red) muscle to power sustained swimming. Although adult tunas can elevate red muscle temperature above ambient water temperature by using counter-current heat exchangers to conserve metabolic heat generated by the red muscle, larval and early juvenile tunas have not developed enough red muscle to maintain elevated temperatures. Elevated red muscle temperatures may be necessary before tunas can expand their range into cooler waters. The purpose of this study was to determine when and how red muscle forms by describing red muscle development in a size series of juvenile yellowfin tuna, *Thunnus albacares*. Fish were raised to sizes of 40.08–74.03 mm fork length (FL) at the Inter-American Tropical Tuna Commission laboratory at Achotines Bay, Republic of Panama. Larger yellowfin juveniles (up to 188 mm FL) were collected by hook and line near fish aggregating devices off Oahu, Hawaii. Samples were frozen in liquid nitrogen, sectioned at 60% of fork length, and stained for succinic dehydrogenase, which differentially stains for the higher mitochondrial density in red muscle fibers. The Scion Image analysis program was used to calculate the amount of red muscle from digital images of each cross-section. The cross-sectional area of red muscle increases with size faster than the total cross-sectional area increases; therefore, %RM increases with FL. As juvenile yellowfin grow, red muscle develops gradually, producing an increasing amount of red muscle to power sustained swimming and to generate heat for endothermy, thereby potentially affecting recruitment and thermal range expansion.

63. AN EMBRYONIC STAGING SERIES FOR THE CALIFORNIA GRUNION, *LEURESTHES TENUIS*

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The California grunion *Leuresthes tenuis* is a beach-spawning marine fish with embryos that develop in a terrestrial environment and do not hatch until environmentally triggered. Spawning and hatching both are linked with tidal height during syzygy tides. Grunion are competent to hatch in 10 days but can delay up to three weeks longer if the oviposition height on shore is not reached by the following syzygy tides. Development must be timed to conserve yolk in case of a delay, while preparing the embryo for instantaneous hatching whenever the tide rises. This study provides the first detailed description of the early embryology of the California grunion. Unfertilized eggs were collected during a spawning run, artificially inseminated, and incubated at 20 ± 1°C in the laboratory. Embryos were observed by light microscopy for delineation into stages. Diagnostic features in the earliest stages include number and relative size of blastomeres, shape of the blastoderm, extent of epiboly, development of optic and otic vesicles, and number of somites. Later, heart development, blood circulation, body movement, tail and fin development, and changes in organs such as the swim bladder, spleen, and gallbladder were examined. Stages are named rather than numbered to allow for expansion and flexibility in the staging series as more is learned about grunion life history. Although grunion development has characteristics in common with the established staging series of two aquatic teleost fishes, the zebrafish and medaka, grunion have unique features related to their terrestrial incubation and dependence on the tidal cycle.

64. MICROSATELLITE AND MORPHOLOGICAL INVESTIGATION OF AN APPARENTLY DISJUNCT NORTHERN POPULATION OF CALIFORNIA GRUNION, *LEURESTHES TENUIS*

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California grunion *Leuresthes tenuis* are marine fish endemic to outer coastal waters of California and Baja California, Mexico. Grunion spawn on sandy beaches completely out of water, every two weeks following the highest tides of the month, from early spring through August. Their traditional range and primary spawning habitat is southern California. Since 2001, small numbers of grunion have been reported from trawl samples in San Francisco Bay, and in 2005, grunion spawning was verified on a sandy beach in the Bay. For our study, grunion were sampled from three locations: Doheny State Beach in Dana Point, Orange County; Malibu Lagoon (Surfrider) State Beach in Malibu, Los Angeles County; and Robert W. Crown Memorial State Beach in Alameda County on the east side of San Francisco Bay. Grunion collected during spawning runs were assessed using morphological measurements and microsatellite primers isolated from *Odontesthes argentinensis* and *O. perugiae*, also from the family Atherinopsidae, the New World silversides. Grunion from San Francisco Bay were significantly smaller in length and mass and also proportionally distinct as well from grunion collected in the two southern locations, but grunion from the two southern locations did not differ from each other. However, our genetic data showed no difference between any of the three populations of grunion. Interpretations of these data include possible recent colonization of San Francisco Bay with heavy selection for adaptive traits in advance of divergence in the neutral genetic markers, or panmixia between grunion populations throughout their range, with high phenotypic plasticity.

65. RECIPE: A NOVEL RESEARCH PROJECT THAT IS MORE THAN HALF-BAKED

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Having completed the acquisition of 1500 acres of coastal sage scrub contained within the greater Los Angeles metropolitan region, the Palos Verdes Peninsula Land Conservancy found itself in a position to promote a standard of excellence for restoring and sustaining native habitat, and for documenting ongoing changes as the habitat improves. Management at the Land Conservancy knew that scientific research was essential for providing feedback to the restoration staff, but also recognized that greater good could be realized through a broad-based community effort. This forward-thinking approach led to the creation of the Research, Education, and Community Involvement Program for the Environment (RECIPE), which is designed to coordinate scientific research and management information for communication to the restoration community and public at large. Supported by Alcoa Foundation, RECIPE is intended to reach

students from elementary through university level work to foster sound scientific education for youth as well as research opportunities for academia. Barely a year old, RECIPE has been well received throughout the community and has a variety of research projects underway. Initial results have shown that the merger of academia with young students and the restoration staff can be an effective process for discovering how to better restore and manage the open space on the Palos Verdes Peninsula. We utilize multiple avenues, such as newsletters, interpretive flyers, and conferences (such as the Southern California Academy of Sciences' Annual Meeting) as well as peer-reviewed journal articles, to communicate the research results to our local community, the restoration community, and academia.

66. EFFECTS OF A PURPOSE-BUILT UNDERPASS ON WILDLIFE ACTIVITY AND TRAFFIC-RELATED MORTALITY IN SOUTHERN CALIFORNIA: THE HARBOR BOULEVARD WILDLIFE UNDERPASS

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Conservationists have advocated the construction of wildlife crossing structures for the purpose of reducing traffic mortality of wildlife and maintaining habitat connectivity in increasingly fragmented landscapes. In May 2006, construction was completed on a wildlife underpass beneath Harbor Boulevard, a four-lane road that bisects the Puente Hills, one of the few remaining large tracts of coastal sage scrub habitat in southern Los Angeles County. We used road-kill surveys, track-stations and remote cameras to monitor the frequency of road-killed wildlife and the activity of medium and large mammals in the vicinity of the underpass before, during and after underpass construction. Our aim was to determine whether such underpasses reduce traffic-related mortality of wildlife and improve connectivity of natural habitats. As of April 2007, coyotes and deer were photographed at the underpass an average of 26.6 and 2.0 times per month, respectively. Track-station activity, and the diversity of species represented, was especially high in the center of the study area, suggesting that wildlife activity is greater farther from more intensely urbanized areas. Incidence of road-kills was very high on Harbor Boulevard relative to the rest of the study area prior to construction; however, as of April 2007, there has been no reduction in the frequency of road-kills on Harbor Boulevard. Although use of the underpass has been relatively high, the lack of any decrease in the number of road-killed animals, suggests that other measures such as fencing might be considered to funnel more animals into the underpass.

67. ETHNOBOTANY IN THE CANADIAN ARCTIC: A SURVEY OF THE COPPER INUIT

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Ethnobotany is the study of how plants are used by people for medicine, food, and material objects. Ethnobotanical research has seldom been conducted in Arctic environments. The Inuit are an indigenous people that currently inhabit Arctic environments in regions north of the tree-line. Inuit territory stretches from Siberia in the west to Greenland in the east. The Copper Inuit are a sub-population of Canadian Inuit who occupy the Kitikmeot Region of the Territory of Nunavut, Canada. Formerly nomadic hunter-gatherers, the Copper Inuit have lived on permanent settlements since the middle of the twentieth century. Despite a departure from nomadism, the Copper Inuit have maintained the practice of subsistence hunting and gathering. This dependency on the environment makes the culture an interesting subject for ethnobotanical research. The objective of this study was to document the use of plants in the traditional medicine, diet, and material culture of the Copper Inuit. An ethnobotanical survey of the plants used by the Copper Inuit was conducted in the Hamlet of Kugluktuk, Nunavut (North 67°47.881′; West 115°13.845′). Data was gathered through unstructured interviews, participant observation, and voucher specimen collection. Uses were documented for 20 plant species contained in 15 families. Thirteen species were used for medicine, seven species were eaten, and a further seven were used as cultural items. These findings are discussed in the context of the traditional and contemporary culture of the Copper Inuit. Further efforts to document traditional Inuit knowledge are indicated by rapid changes in Arctic culture and climate.

68. MALE CRICKET AGGRESSION AND PREDATION RISK: MALE CRICKETS FIGHTING OVER SPIDER SILK

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Male crickets engage in aggression to defend or obtain resources. However, aggression may cause males to be conspicuous and vulnerable to predators. Male crickets may reduce aggression to limit predation risk. I tested the hypothesis that perceived predation risk will influence male aggression in house crickets, *Acheta domesticus*. Paired males were observed under varied degrees of perceived risk and potential benefit. Perceived risk was manipulated by adding spider silk and feces from Western Black Widows and funnel-weaving spiders. Perceived benefits were manipulated by adding cues from three virgin, female crickets. Controls consisted of no cues from female crickets or spiders. Residents showed significantly more aggression and won more contests when presented female cues than no cues, but residents showed no difference in response to funnel-weaver silk. However, male crickets showed significantly more aggression and won more in the presence of black widow silk than any other treatment. All spiders were fed a diet of crickets prior to trials. Additional observations were made using silk from black widows fed mealworms to test if silk cues may be diet based. Crickets showed significantly less aggression and won fewer contests in this treatment than cricket-diet-black widow silk. Results suggest that crickets do not use these spider cues for predation warnings. It appears that black widows may embed cues from their prey into the silk and/or feces. This result suggests a novel diet-based mechanism by which certain web-building spiders might increase the attractiveness of their webs and have higher prey capture.

69. A COMPARISON OF PREDATORY AND NON-PREDATORY MAMMAL MANAGEMENT POLICIES IN THE ELEVEN WESTERN STATES

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This thesis examines the management policies of predatory mammals as they compare to the management policies of non-predatory mammals in the eleven Western States. Policies were measured for bias by determining the minimum number of discrete actions required for the legal take of each mammal under study; these discrete actions are defined as layers of protection (LOP). The results yield qualitative numeric values indicating consistent bias against predatory mammals. This study includes discussions of trophic influences imparted by large mammalian predators on ecosystems, historic origins of anti-predator bias, emerging multi-disciplinary predator management policies, and suggestions for future policies based on appropriate environmental concerns from an ethical perspective. Results of this study indicate both ethical and unethical biases within existing state wildlife management policies. I offer suggestions for creating predator management policies that are both ethical and take into account the necessary public safety issues that are becoming increasingly relevant due to a rapidly expanding urban-wild interface

70. MOTH DIVERSITY ALONG AN ELEVATIONAL GRADIENT IN SOUTHEAST ARIZONA

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The factors that influence biodiversity are the focus of much research in ecology and conservation biology. Our research focuses on moth communities along an elevational transect in the Santa Catalina Mountains in Arizona. The differences in climate along this elevational gradient are correlated with changes in plant communities which shift from desert scrub at low elevation to mixed conifer forest at high elevations. I predicted that, due to their herbivorous nature, moth communities will change as do the plant communities. In addition, the Rapoport-rescue hypothesis predicts that moth diversity will peak at an intermediate elevation due to overlap of species ranges towards the middle of an environmental gradient. To measure moth diversity, blacklight traps were placed at four sites differing in elevation and plant community. Moths are currently being sorted to morphospecies. To date, 10,115 moths have been sorted from 553 morphospecies from the June sampling period. There are substantial differences in species

diversity and community composition at different elevations. The highest diversity appears at middle elevations and appears to be a function of increased overlap with species from high elevations. This is a preliminary report on my results; further analysis includes several analyses of samples from July and August. These data help us to gain a better understanding of the vast diversity of insect communities on these mountains and how abiotic and biotic factors might influence their distributions.

71. DIFFERENTIALLY ALTERING THE ABILITY OF *HAEMOPHILUS INFLUENZAE* TO FORM BIOFILMS BY USING SUBTHERAPEUTIC DOSES OF MULTIPLE ANTIBIOTICS

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When studies began showing the concept of antibiotic resistance, researchers felt that the remedy was to give patients lower dosages of antibiotics, as subtherapeutic dosages lead to the inhibition of initial microbial adherence. However, the flaw in such thinking was that all antibiotics behaved the same way at subtherapeutic doses. Additionally, it was believed the difference between planktonic cells (individual bacterium) and biofilms (many bacteria) was virtually none. Bacteria are actually in biofilms for the duration of their existence. It is only when making the transition from biofilm to biofilm that the bacteria are in a planktonic state. The difference between planktonic cells and biofilms is that the latter are much more resistant to antibiotics than are planktonic cells. In order to treat antibiotic resistance, biofilm formation must be observed.

96-well microtiter plates were used throughout the experiment, as they go beyond Petri-dishes which are only able to test for planktonic cell growth and inhibition. Microtiter plates have the ability to test for biofilm growth and inhibition, as they can be introduced to a Victor 3-V Perkin Elmer, 595 nm, plate reader. As biofilms are the predominant state of bacteria, it was fitting to use a plate reader which tested for biofilm growth of Haemophilus influenzae after crystal violet had been added, followed by water, and finally the addition of ethanol.

The plate reader showed a significant biofilm spike for Benzylpenicillin. In other words, Benzylpenicillin was shown not only to fail at subtherapeutic doses, but also to cause patient health to drastically worsen as biofilm formation increased at such a low dose. This spike is what contributes to antibiotic resistance in patients.

Often times patients do not fully finish taking their antibiotics or are started on a sub-therapeutic dose. In the case of some antibiotics, such as Benzylpenicillin, this method leads to a rendering of a much more harmful bacterium than would have been present had no antibiotic been administered or had an MIC (Minimal Inhibitory Concentration) dose been put into place immediately.

72. IS YOUR BEACH IN HOT WATER? WARMING WATER TEMPERATURES CAUSE ERRONEOUS BACTERIAL EXCEEDANCES USING STANDARD BACTERIAL METHODS

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The summer of 2006 saw unusually high water temperatures throughout Southern California. In July and August of that year, a large embayment popularly used for recreational purposes experienced a surprising number of fecal indicator bacteria exceedances. Upon investigation, no presence of human contamination was found. Parallel studies were then performed involving several known methodologies for analyzing bacterial counts. It was determined that the method being used for bacterial analysis, IDEXX Colilert®-18, reported *E. coli* results significantly higher than those obtained using the more traditional membrane filtration and multiple tube fermentation methodologies. False positives were suspected due to this unusual occurrence and research turned to the *Vibrio* genera of bacteria due to its tendency to bloom in warm waters. In order to check for the presence of these organisms, Colilert®-18 positives were plated directly on media known to select for *Vibrio* species. Growth was present on all plates, and likely species included *Vibrio parahaemolyticus* and *Vibrio alginolyticus*. Additional investigations determined that a slight change in the methodology involving diluting the sample volume analyzed from 1:10 to 1:20 resulted in counts comparable with other methodologies. Findings from this

study ultimately led to changes in analysis methodology for the San Diego County Department of Environmental Health AB411 sampling program and others.

73. CONSEQUENCES OF MANY GENERATIONS OF HYBRIDIZATION UNDER BOTH STRESSFUL AND BENIGN CONDITIONS

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Although it is well established that hybrid fitness problems are often delayed until the second generation, little is known about the consequences of hybridization in later generations. Much work has focused on natural hybrid zones where populations have been hybridizing for long time periods, but in order to better understand the process of hybrid speciation, it is necessary to also observe intermediate hybrid generations. The intertidal copepod, *Tigriopus californicus*, serves as an excellent model for hybridization studies due to its ease of husbandry and the ability to set up controlled crosses for genetic manipulation. Its short generation time (~23 days) and abundance of population-specific markers makes it a particularly tractable system for studying the outcomes of hybridization over multiple generations. This study uses *T. californicus* to assess hybridization in both benign and stressful (high salinity) conditions. Here we report morphometric and fitness data after 18 months of experimental hybridization. In particular we are interested in determining (1) if environmental stress alters the magnitude or duration of outbreeding depression and (2) whether or not hybridization can generate new genetic variants that are favored under environmental stress. This work is directly relevant to current concerns about the impacts of invasive species mixing with native populations, or farmed organisms mixing with wild populations. It also provides an example of the long-term consequences of hybridization under both benign and stressful conditions in a rigorous way that would be difficult to achieve for most species of concern.

74. PERSISTENCE AND ITS LIMITING FACTORS IN SOUTHERN CALIFORNIA KELP BEDS

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Sporadically over the past century and consistently over the last four decades, kelp beds have been monitored frequently enough for it to be well known that kelp beds do not typically persist for long periods of time. Herein we explore the reasons for the lack of persistence in southern California kelp beds by means of kelp bed maps and aerial photography collected from a variety of sources. The persistence of an individual bed is dependent on many variables some of which are naturally occurring environmental perturbations such as nutrient availability as dependent on manifestations of El Niños and La Niñas, storms, sediment deposition, persistent phytoplankton blooms, and anthropogenic influences such as wastewater discharges, erosion, and predator-prey imbalances brought on by overfishing.

By looking at the long-term record dating back to Crandalls original giant kelp maps of 1912, we have a baseline to explore the persistence of the kelp beds of southern California. Although information is sketchy for the first half century of the 1900s, enough is available to document large changes in the giant kelp beds that were probably caused by anthropogenic influences or normal coastal processes. These would include the loss of whole kelp beds such as the Sunset Kelp Bed, Palos Verdes Kelp Bed, the Dago Bank Kelp Bed (Horseshoe Kelp), Doheny Kelp Bed, Santa Margarita Kelp Bed, the Mexican Border Kelp Bed, and the reduction in size of numerous kelp beds along the southern California coast. Interestingly, at least one kelp bed now exists where none was recorded by Crandall in 1912.

The long-term record can also give us insight to better understand the cyclical natural processes which also affect kelp bed persistence. These well known environmental perturbations of the oceanographic regime were added to in 2005 and in 2006. In those two years we saw losses throughout the Southern California Bight that were probably caused by excessive phytoplankton blooms reducing available light. These very normal (almost yearly) occurrences persisted long past typical durations and probably were the responsible agent for large decreases seen in 2005 and in 2006.

The more than 50 distinct beds that occur offshore of Ventura, Los Angeles, Orange, and San Diego Counties have been surveyed during the past century which allows for a temporal view of each of the major kelp beds. From this review, insight is provided of the kelp beds response to and the aftermath of these limits to growth of our kelp beds.

75. A SATELLITE DERIVED DATABASE OF GLOBAL KELP CANOPY DISTRIBUTION

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A global database of kelp canopy distribution was produced from NASA GeoCover images for the years 2000 and 1990. The GeoCover images are a global set of cloud-free LandSat 5 Thematic Mapper (TM) and LandSat 7 Enhanced Thematic Mapper (ETM+) imagery funded by NASA and processed by MDA Federal Inc. The ETM+ imagery has a spatial resolution of 28 m and has three bands in the visible spectrum and one near-infrared band that are useful for kelp mapping. The kelp canopy regions were identified by first masking the land potions of the imagery so that the classification process could focus on the nearshore regions and then conducting a minimum spectral distance unsupervised classification. The accuracy of the classification process was evaluated using a variety of independent data sources in southern California, Baja California, southeast Alaska, central Peru, and northern Chile. The kelp canopy areas along the west coast of North America were identified accurately from the satellite imagery. However, many of the beds of *Macrocystis integrifolia* in Peru and northern Chile were missed in the classification process. This appears to be due to the narrow width of these beds and their position adjacent to the shoreline. This study has shown that LandSat imagery is a cost-effective method for monitoring kelp populations in remote regions, such as the subantarctic islands; where surveys are infrequent, but where global climate change could have significant impacts on kelp distributions. The kelp canopy polygons are available in kml format for viewing in Google Earth.

76. PHOTOACCLIMATION ALONG A VERTICAL GRADIENT IN DIFFERENT GROWTH STAGES IN THE ELK KELP, *PELAGOPHYCUS PORRA*

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The Elk Kelp, *Pelagophycus porra*, is commonly observed in deep (20–30 m) water on the outer edge of Giant Kelp, *Macrocystis pyrifera*, forests in southern California and northern Baja California, but rarely occurs in shallower water or within the giant kelp beds. We used a series of transplant experiments, demographic monitoring, and physiological measurements to investigate *P. porra*'s apparent inability to encroach into the more abundant giant kelp beds along the southern California coast. Our results indicate that transplanted *P. porra*'s juveniles exhibit similar growth and survival across a vertical gradient. Physiological measurements using PAM fluorometry indicate that while this species exhibits characteristics of a species adapted to low light environments, such as deep-water habitats, individuals are able to photoacclimate to increasing light levels as they grow towards the surface. This ability to photoacclimate is variable within the large (up to 20 m long) blades, with portions near the surface behaving like light-adapted species and parts hanging in deeper water behaving like shade-adapted species. These results show that this deep-water species has the capability to function as both a low light and a high light adapted species as it grows through the water column as well as simultaneously within a single blade.

77. COMMUNITY-BASED GIANT KELP RESTORATION AND MONITORING IN ORANGE COUNTY, CALIFORNIA

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Historical data indicate that Orange County kelp densities have decreased significantly over the last 25 years. In 2001 a Community Based Giant Kelp (*Macrocystis pyrifera*) Restoration Project began to restore kelp on reefs in Orange County where it historically grew. The (12) 1500 m^2 restoration sites were established over a period of four years. Before any restoration occurred, the reefs were mapped and species abundance and diversity was assessed. A variety of restoration techniques were used. Annual monitoring continued throughout the restoration process. All work was performed by community volunteers under the direction of a lead biologist. These activities are part of a regional project spanning the Southern California bight

78. RESTORED KELP BEDS OFF OF MALIBU AND PROGRESS OFF PALOS VERDES, WORTH DIVING FOR

T. Ford. Santa Monica Baykeeper Kelp Restoration and Monitoring Project, P.O. Box 10096, Marina Del Rey, CA 90295

Swath transects performed in the fall of 2006 describe the successful development of *Macrocystis pyrifera*, in three separate restoration areas off of Escondido beach, Malibu California. An additional area off of Long Point Palos Verdes is in the earlier stages of restoration. Descriptions of actions taken to restore giant kelp communities within Santa Monica Bay and progress to date off of Long Point Palos Verdes will also be presented.

79. FISH-HABITAT ASSOCIATIONS AND THE ROLE OF DISTURBANCE IN SURFGRASS BEDS

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Many studies have been conducted on seagrass communities in protected bays and estuaries as important nursery grounds for fishes and invertebrates. By contrast, there have been few studies investigating faunal-habitat associations in open coastal environments and only one study that has documented the fishes associated with surfgrass beds in southern California. In this study, I explored recruitment and the abundance of older life stages of fishes in surfgrass (*Phyllospadix torreyi*) beds along the open coast of San Diego County. I recorded fishes in surfgrass beds and quantified seven variables of habitat structure on each bed. As expected, the variables that explained variation in the density of fishes were species-specific. Because surfgrass beds are subject to disturbance and loss of habitat may alter the abundance of fishes, I reduced the area of surfgrass beds by 50% and compared the abundance and structure of fish assemblages with unmanipulated beds. Older juvenile and adult fishes showed no response to loss of surfgrass habitat, while recruits showed stronger and more complex responses. Species richness of recruits was lower on disturbed than unmanipulated beds, and the density of recruits on surfgrass only showed a significant interaction between treatments. The densities of recruits of most species were higher on the undisturbed vs. disturbed side of a bed, except for the rock wrasse which showed an opposite pattern. This is the first study to explore fish-habitat relationships in subtidal surfgrass beds and to assess the subsequent impacts of disturbance.

81. EXTRAPOLATING RESULTS OF SMALL-SCALE FIELD EXPERIMENTS TO ENHANCE POPULATIONS OF A CORAL REEF FISH AT LARGE SPATIAL SCALES

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Although field experiments allow rigorous tests of ecological hypotheses, they are usually limited to small spatial scales. We often want to know if their findings extrapolate to larger scales, especially when applying their results to conservation and management. We show first that that density-dependent mortality of reef fish on small habitat patches scales-up to have similar effects on much larger entire reefs that are the size of small marine reserves and approach the scale at which some reef fisheries operate. This result is in accord with a scaling model which indicates that localized events can be aggregated to describe larger-scale interactions with minimal distortion. Experiments on small habitat patches reveal that predators inflict locally density-dependent mortality. As prey become crowded, they suffer a progressively increasing shortage of structural refuges. A manipulation of refuge abundance on entire reefs suggests that a similar interaction occurs at this much larger scale, and enhancing refuge abundance enhances population size at this large scale. The results so far suggest that careful extrapolation from small-scale experiments identifying species-interactions may be possible, and so should improve our ability to predict the outcomes of alternate management strategies for coral reef fishes.

82. THE RELATIVE EFFECTS OF BIOGEOGRAPHY AND SIZE-SELECTIVE FISHING PRESSURE ON THE POPULATION STRUCTURE AND SEX-CHANGE DYNAMICS OF THE CALIFORNIA SHEEPHEAD, *SEMICOSSYPHUS PULCHER*

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California sheephead present an especially interesting challenge in environmental monitoring because they begin life as females and transform into males as they age, forming a harem mating system based on the few large dominant males in the population (Alonzo, 2004b). Depending on the fishing method (live trap, setnet or hook-and-line), recreational and commercial fisheries tend to specifically target either large males or small immature females (Alonzo, 2004a, Adreani, et al. 2004). In this study, populations of California sheephead were analyzed through SCUBA transect data and specimen collection in order to assess the effects of size-selective fishing pressure on the species. While mean fish density appeared to be a function of biogeography and habitat, mean fish size and sex distribution appeared to vary with other influences such as fishing pressure. Fish were consistently larger at remote sites such as Anacapa and Santa Barbara Island, although marine reserves placed in more heavily fished locations were only effective when they were of ample size and suitable habitat. A preliminary GSI curve confirmed the summer spawning season described in previous papers. However, at many of the Santa Catalina Island sites, transitional fish were observed during the summer months, an unexpected occurrence indicative of a disturbed population. Gonad histology confirmed this phenomenon, although the structure of summer transitional gonads was different from transitional gonads collected over the winter. In addition, populations of California sheephead at mainland populations grew at a faster rate and in a different pattern than those at Santa Catalina Island.

83. ISOLATING THE EFFECTS OF LARVAL SOURCE ON THE POPULATION OF A MARINE INVERTEBRATE

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The design of a large artificial reef combined with data from two nearby natural reference reefs has provided a unique opportunity to assess the relative importance of recruitment and post-settlement mechanism on populations of the sea fan, *Muricea californica*. Three significant recruitment events occurred between 2000 and 2005 on the reefs located in southern Orange and northern San Diego counties. Numbers of adult sea fans were strongly affected by recruitment of young-of-the-year sea fans, whereas post settlement mechanisms associated with location and habitat complexity had little effect. Modeling results indicate the initial numbers of adults also have little effect on long-term population trajectories, whereas recruitment and survival rates of the young recruits have a strong influence. Model results also indicate that small differences in these two rates can result in vastly different long-term population numbers. We discuss the implications of these results on the long-term performance and maintenance of a one of the largest artificial giant kelp (*Macrocystis pyrifera*) reefs yet to be constructed.

84. DEMOGRAPHIC PARAMETERS OF YELLOWFIN CROAKER, *UMBRINA RONCADOR* (PERCIFORMES: SCIAENIDAE) FROM THE SOUTHERN CALIFORNIA BIGHT

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Yellowfin croakers, *Umbrina roncador*, are a common nearshore and surf zone species in the southern California bight. 1209 individuals were aged using otoliths. The maximum age was 15 and the von Bertalanffy parameters for females were significantly different than those of males. Females grew faster and larger. Based upon samples collected between 2003 and 2004, annual and instantaneous mortality estimates were A = 0.4492 and Z = 0.5964. Males and females were found at all size classes and in 51:49

ratio that was not significantly different from a 50% sex ratio indicating that these fishes were gonochores. Fishes were reproductive in the summer months with gonadosomatic indices (males = 5.65% and females = 5.51%) consistent with group spawning fishes. In two separate monitoring programs, their abundance fluctuated appreciably between from 1993–2004 and was declining significantly by the end of this program. This trend was consistent with declining recruitment during this time period.

85. FISH SPECIES COMPOSITION FROM THE SOFT-BOTTOM OF BAHÍA DE LOS ÁNGELES, BAJA CALIFORNIA, MEXICO (2005–2007)

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We studied the composition of the soft bottom fish community at Bahía de Los Angeles, Baja California, México. Six seasonal samples were made during November 2005, February, April, August, November 2006, and February 2007. During each sampling period, we collected fishes using four replicate otter-trawl (5 and 10 m-depth), beach-seines (<3.5 m-depth), and gill-nets (5,-depth), and using hook-and-line. All the species were identified, the number of individuals was recorded, the biomass and size of all fishes were measured and the seasonal variation in the community was determined. A total of 2638 individuals representing 67 fish species were collected. The number of species collected at each sampling period varied from 19 (November 05) to 30 (April and November 06). The number of fishes collected was greatest during spring (April 06) and summer (August 06) when 51.2% (1,350 fish) of the total number of fishes was collected. The most abundant species was *Paralabrax maculatofasciatus* with 895 individuals (33.3%) collected over the course of the study and 506 individuals (56.5%) collected during the summer season (August 2006). *Sphoeroides annulatus* was the second most abundant species (9.4%), followed by *Urobathis halleri* (9.4%), *Etropus crossotus* (6%), and *Xenistius californiensis* (5.1%). According to cumulative abundance of fish species, 22 species accounted for 90.7% of the fishes collected during this study. A number of 23 "rare" fish species with only one or two individuals collected, accounted 1.2% of the total number of individuals. We discuss here the patterns of seasonal variation in the abundance and the occurrence of the most important fish species, using the Index of Community Importance (ICI).

86. IMPACTS OF HABITAT USE ON CONTAMINANT CONCENTRATIONS IN SEVERAL SPECIES OF FISHES COLLECTED IN THE PALOS VERDES SUPERFUND SITE

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Fish from the Palos Verdes peninsula typically have elevated DDT and PCB concentrations due to contamination in the sediments in this region. Concentrations vary among individuals and species in ways that deviate from conventional wisdom that bigger, higher trophic level species are more contaminated. Movement patterns and habitat use may also impact exposure and accumulation of contaminants, but the importance of these factors may be mediated by the nature of the source of the contamination (local point source vs. non-point source). We examine PCB/DDT (point source) and mercury (non-point source) contaminant concentrations of species within two families (Scianidae, Serranidae), to determine how differences in habitat preferences relate to magnitude and variance in contaminant concentrations. Two Serranide species (*Paralabrax clathratus* and *P. nebulifer*) are upper trophic level species that used reef and soft bottom habitats to differing degrees. Two scianide species (*Genyonemus lineatus*, and *Seriphus politus*) are lower trophic level species, the former forages from the substrate and is typically associated with soft sediments and the latter forages from the water column and is typically higher in the water column. In addition to these species, contaminant concentrations in a surf zone scianide (*Menticirrhus undulates*) and a reef-associated herbivore (*Girella nigricans*). These comparisons confirm that habitat use patterns may play a much bigger role than body size and trophic status in determining DDT/PCB concentrations for the Palos Verdes superfund site, and perhaps other sites where the source of the contamination is localized geographically and contained within specific habitats.

87. BALLONA WETLANDS – BOLD VEGETATION GIS MAPPING PROJECT

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In the summer of 2006, a GIS mapping project was started in the BOLD project area of the Ballona Wetlands. This project was undertaken to provide baseline information on the native and non-native plant cover for this site using GPS data and GIS software to map both. Some issues using older equipment were encountered and these issues have been incorporated in the project notes. Using the software, a map has been produced which indicates that a substantial portion of the site is covered with non-native species, including ice plant (*Carpobrotus edulis*), lollipop trees (*Myoporum laetum*), and invasive grasses. These data will be used in monitoring changes consequent on restoration

For example, in the fall of 2006, the salt water flushing of the system was increased by allowing the tidal flood gates to remain open to a higher tidal level. In late spring of 2007, critical areas of the area have been remapped and changes in the plant distributions noted.

88. THE EFFECT OF DL-HOMOCYSTEINE ON MINERALIZATION IN OSTEOBLAST-LIKE CELL CULTURES

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Recent clinical studies document elevated homocysteine (Hcy) serum levels in osteoporotic patients and homocysteinuria is clinically associated with osteoporotic fractures. It is well known that Hcy, an intermediate sulfur-containing amino acid, elicits specific responses from a variety of cell types. However, the cellular mechanisms leading to its effects on the bone cells responsible for mineralization remain incompletely understood. This study investigates the effects of exogenous Hcy on mineralization in the osteoblast-like cell line, UMR 106-01 BSP (UMR cells). UMR cell cultures, treated with varying concentrations of DL-homocysteine in the presence of 0.1 mM copper sulfate, were incubated at 37°C for 60 hours. The cell cultures were subsequently treated with beta-glycerophosphate (7.0 mM) for 24 hours to stimulate mineralization. Cell cultures were washed, fixed in ethanol and stained with alizarin red. Mineral content were quantified using a microplate reader (SpectraMax 190). Hcy concentrations inversely correlated with mineral deposition in the UMR cell cultures. Therefore, elevated Hcy concentrations are associated with poor mineral deposition in UMR cell cultures *in vitro*. Continued studies will be necessary to further elucidate the role of Hcy in bone mineralization in osteoporotic patients.

89. NEUROTOXINS IN OUR ENVIRONMENT

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BMAA (β-methylamino-L-alanine) is an unusual neurotoxic amino acid found in Guam in the cycad *Cycas micronesica* Hill. Biomagnified cycad neurotoxins are linked with the high incidence rates of ALS/PDC, a neurological disease prevalent among the indigenous Chamorros people of Guam. Two years ago, researchers identified that cyanobacterial root symbionts of the genus *Nostoc* produced BMAA. BOAA (β-oxylamino-L-alanine), found in plants of the genus, *Lathyrus*, is another unusual, neurotoxic amino acid similar in structure to BMAA and known to cause lathyrism, a disorder resulting in lower-limb paralysis linked to excessive consumption of the grass pea *Lathyrus sativus* in India, Bangladesh, and Ethiopia. Since *L. sativus* is a leguminous plant species that lives in symbiosis with nitrogen-fixing rhizobia, we hypothesized that the rhizobium itself could be responsible for the production of BOAA in *Lathyrus* and potentially other legumes. We also hypothesized that BMAA could be another possible product of rhizobium bacteria. We tested commercially produced rhizobium used as an inoculant to promote healthy leguminous plants for both BOAA and BMAA. We also tested green beans (*Phaseolus vulgaris*) and snap peas (*Pisum sativum*) from local Farmer's Markets for BOAA and BMAA. All analyses were completed with HPLC analytical techniques. Low concentrations of BOAA were found in *P. vulgaris*

and *P. sativum*, and both BMAA and BOAA were found in rhizobium inoculants. Further investigations using mass spectrometry analysis are now necessary to confirm amino acid identifications.

90. EVIDENCE FOR RAPID LAKE LEVEL CHANGE DURING THE LAST GLACIAL MAXIMUM IN SOUTHERN CALIFORNIA (LAKE ELSINORE)

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A sediment core from the littoral zone of Lake Elsinore, southern California's largest natural lake, provides insight to the climate of southern California from ~22,000–17,000 calendar years BP. Sedimentological data including lithologic description, mass magnetic susceptibility, LOI 550°C, and LOI 950°C indicate rapid changes in the depositional environment at the core site. We interpret these changes as representing variations in lake level and its associated type of sedimentation. For example, we interpret sand as similar to the modern "beach" environment (i.e., low lake level). Conversely, clays represent a deep lake environment (i.e., high lake level). Based on our multi-proxy methodology, we infer an interval of low lake level ca. 22,000 cy BP. From 22,000 cy BP to ~20,300 cy BP, lake level was highly variable reaching a brief high stand centered on 20,070 cy BP and ending by 19,700 cy BP. This high stand is followed immediately by an abrupt regression as evidenced by sand-rich sediment. The timing of this abrupt regression at Lake Elsinore is correlative to the onset of a pronounced lowstand at Owens Lake at ca. 19,700 cy BP (Bacon et al., 2006). By 19,500 cy BP, lake level begins to rise, peaking by 17,900 cy BP. After 17,900 cy BP, there is an inferred gradual lake level regression reaching a sustained low lake level – but higher than the coring site – by 17,120 cy BP. This transgression-regression cycle is observed at Owens Lake by Bacon et al. (2006). These results indicate that the Last Glacial Maximum climate of Southern California was highly variable and regionally congruent.

91. BURST SWIMMING PERFORMANCE AND METABOLIC ENZYME ACTIVITIES IN LARVAL AND JUVENILE WHITE SEABASS (*ATRACTOSCION NOBILIS*)

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The white seabass (*Atractoscion nobilis*) is a large sciaenid fish important to commercial and sport fishing that ranges from Alaska to southern Baja California. Burst swimming is involved in predator escape and is believed to play a key role in fish survival. The purpose of this study was to quantify how burst swimming performance and glycolytic enzyme activities change in developing larval and early juvenile white seabass. Fish were obtained from the Hubbs-Sea World Research Institute Ocean Resources Enhancement Hatchery Program and were reared in the laboratory at 20°C. Fish maximal speed during burst swimming (Umax) was measured in individual fish, ages 1 to 31 days post-hatch, by analyzing video captured at 120 Hz. The activity of the enzymes creatine phosphokinase (CPK) and lactate dehydrogenase (LDH), which produce ATP in glycolytic muscle to power burst swimming, were measured in the same individuals. It was hypothesized that Umax would increase with fish size and that CPK and LDH activities would positively correlate with Umax. We found that both Umax and CPK activity increased with total length, but there was no relationship between LDH activity and total length. Once size affects were accounted for, neither CPK nor LDH activities correlated with Umax. Thus, CPK and LDH activities are not indicators of burst swimming performance in individual larval and early juvenile white seabass. The increase in Umax with total length should lead to an increase in the ability to escape predation and thus an increase in fish survival.

92. SONG RECOGNITION IN PLAYBACK EXPERIMENTS IN ANNA'S HUMMINGBIRD, *CALYPTE ANNA*

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Catchpole (1982) developed a basic model of song function based on songbirds: simple songs are for territory defense and complex songs are for mate attraction. Hummingbirds are not songbirds, and

hummingbird species vary in the complexity of their song. Our lab is studying the function of song in hummingbird sister species with similar habitats and behaviors, but very different songs: Anna's hummingbird (*Calypte anna*), which has a complex, learned song, and Costa's hummingbird (*Calypte costae*), which has a simple song that is believed to be innate. I conducted neighbor- stranger song playbacks to determine if male Anna's hummingbirds can distinguish between individuals' songs and if the songs are used in territorial defense. Each bird was exposed to four trials, in random order: a neighboring Anna's song, a stranger Anna's song, a Costa's song and a house finch song. I measured several behavioral responses to song playback: number of vocalizations, flyovers, dives, time spent singing, and closest approach to speaker. All birds reacted aggressively toward playback of both neighbor and stranger songs, but did not respond to the song of a Costa's hummingbird or house finch.

93. BMAA, A NEUROTOXIN IN THE TRADITIONAL CHAMORRO FOOD

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Over a decade ago, researchers hypothesized that an unusual neurotoxic amino acid BMAA, isolated from the seeds of cycad trees, may be the cause of the high levels of ALS/PDC in Guam. It was believed that BMAA was consumed in the traditional diet of the indigenous Chamorros people of Guam, as a byproduct within cycad flours. Early studies suggested that free-BMAA was almost entirely removed in the traditional washing process. However, more recent work suggests that these early studies missed BMAA incorporated into the protein fraction of the flour. We hypothesized that although the concentration of BMAA in the form of free amino acids is very low, there remains a sizable portion of BMAA in the protein fraction of washed cycad flour. We mimicked the traditional Chamorro method of seed preparation to obtain the cycad flour. Next, we quantified the amount of BMAA in both the free and protein bound fractions using HPLC. We found low concentrations of BMAA as a free amino acid in the washed seeds and high levels of BMAA in the protein portions of the flour. The current findings indicate that free BMAA is almost entirely removed during the traditional method of washing, consistent with the early studies. However, there is a large quantity of BMAA that remains in the protein fraction of the cycad flour. We suggest that this represents a significant contribution of BMAA to the traditional diet of the Chamorro people in Guam and supports the original hypothesis suggesting that BMAA is linked to the cause of ALS/PDC.

94. CHARACTERIZING THE UPSTREAM REGULATORY REGION OF BP180

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The lab created a mouse line expressing *dominant negative Clim* (DN Clim) under the control of the *keratin 14 promoter*, which is able to out-compete wild type Clim in binding factors associated with Clim. An expression profile study was done at various time points in development with RNA from these mice, and two genes were down-regulated across all time points. One of these genes was *BP180* or *Collagen XVII.*

BP180 is a transmembranous component of *hemidesmosomes*, attaching structures within *basal keratinocytes*, which stabilize the connection between the epidermis and the dermis by linking the keratin intermediate filament network to the anchoring filaments of the basment membrane. The expression of *BP180* has been detected in skin as well as other tissues such as cornea, umbilical cord, prostate and testis to name a few.

To date, nothing has been reported on the regulatory region of *BP180.* The objective of this project was to characterize the upstream regulatory region of this gene and to determine if Clim and cofactors of Clim are important for its expression. This was done by constructing fragments spanning the 1.35 Kb upstream region of *BP180* by PCR, and cloning these fragments into a luciferase vector. With each vector containing a different piece of the putative regulatory region of *BP180*, they was transiently transfected into *HaCaT cells*, which are human *keratinocytes*, with or without dominant-negative Clim. The efficiency of each fragment to either promote or repress gene expression was then analyzed by *luciferase assays.*

95. AGGRESSION AND BIG HEADS: SEXUAL DIMORPHISM IN HOUSE CRICKETS (*ACHETA DOMESTICUS*)

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Males and females in many species are different as a consequence of the different selective pressures acting on each sex. In species where males engage in combat to defend territories or mates, males tend to have exaggerated morphology or larger body size compared to females. In house crickets, *Acheta domesticus*, male crickets defend resources by engaging in a sequence of behaviors. Mandible flaring is a striking visual display used in cricket fights where males spread their mandibles open. This presumably acts as a visual signal of body size and an indicator of willingness to fight. We tested the hypothesis that sex differences in the signals used for aggressive interactions (females don't mandible flare) will lead to sex differences in the size and shape of the head in house crickets. To test this hypothesis we made linear measurements of body and head size on male and female crickets and utilized geometric morphometric methods to reconstruct sex differences in shape. As predicted, males had larger heads than females and there were significant shape differences. In addition, allometric relationships between head size and body size indicated that head size increases faster than body size in males. Geometric morphometric analysis indicated that the shape differences result in an exaggeration of the mandibular area in males compared to females. These data suggest the differential selective pressures acting on males and females can not only lead to differences in size but also differences in shape related to signal structure and function.

96. DOCUMENTATION OF COYOTES ON THE PALOS VERDES PENINSULA

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Popular knowledge has held that coyotes moved onto the Palos Verdes Peninsula in the mid-1990's, a phenomenon bolstered by residential sightings and complaints about missing cats and other small animals. Despite the general knowledge that coyotes are living on the Peninsula, no scientific studies have been conducted to determine their presence and where exactly they abound. We began a study to investigate the coyotes' existence by surveying for coyote scat and footprints. Our surveys, conducted in the major canyons of Rolling Hills and the Canyons Ecological Preserve of the Portuguese Bend Nature Preserve, revealed the presence of coyote scat and tracks. We will use this initial survey as part of an ongoing study to determine the areas and movement corridors utilized by coyotes throughout the Peninsula. Additionally, we expect to use our results to help residents take proper measures for living harmoniously with coyotes.

97. HAS THE STATEWIDE BAN ON *CAULERPA* SPECIES BEEN EFFECTIVE? A SURVEY OF SOUTHERN CALIFORNIA AQUARIUM RETAIL STORES

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The *Caulerpa taxifolia* invasion in the Mediterranean Sea raised awareness of the potential for introduced seaweeds to impact coastal communities. Subsequent introductions of *C. taxifolia* in southern California in 2000, presumably from the release of aquarium specimens, cost ~$4.5 million for eradication efforts. Besides *C. taxifolia*, other *Caulerpa* species being sold for aquarium use also may have the potential to invade southern Californian and U.S. waters. Surveys of the availability of *Caulerpa* species in southern California aquarium retail stores in 2000–2001 revealed that 26 of 50 stores sold at least one species of *Caulerpa* and seven stores sold *C. taxifolia*. In late 2001, California imposed a ban on the importation, sale, or possession of nine *Caulerpa* species (DFG Code 2300); the City of San Diego expanded these regulations to include all species. To determine the effectiveness of the California ban, we surveyed *Caulerpa* availability at 44 of the southern California retail stores in 2005–2006 sampled in our

previous study. Similar to previous methods, specimens of *Caulerpa* species were purchased, identified, and preserved. Of the 44 stores, 23 sold *Caulerpa* and three stores sold *C. taxifolia*. Three additional stores had *Caulerpa* species in stock but not for sale. These results suggest that the California ban on *Caulerpa* species has not been effective and that the retail aquarium industry continues to represent a potential vector for distributing *Caulerpa* specimens, including *C. taxifolia*. This study underscores the need for outreach and enforcement programs to increase awareness among the aquarium retail industry and aquarium hobbyists.

98. ECOTONE BIODIVERSITY IN THE CHAPARRAL–RIPARIAN TRANSITION

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In Eaton Canyon (Pasadena CA.) plant species diversity was surveyed from the riparian woodland to the chaparral paying close attention to the ecotone between them. The ecotone displayed a higher diversity than either the riparian zone or the chaparral communities alone. Counter to expectations, the riparian zone had the lowest species diversity of the three zones surveyed. The overwhelming presence of the invasive species sticky eupatorium (*Ageratina adenophora*) may be limiting the diversity in the riparian plant community.

99. ETHYLENE AS A POSSIBLE GERMINATION CUE FOR SAND VERBENAS (*ABRONIA* SPP., NYCTAGINACEAE)

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Sand verbenas (*Abronia* spp., Nyctaginaceae) are psammophilous species occurring in open and often disturbed habitats in western North America, especially coastal dune communities along the Pacific coast and sandy desert habitats. Most species are obligate outcrossers which produce anthocarp-surrounded achenes that are wind dispersed. High- rainfall years result in extensive germination and flowering of *Abronia* species in the deserts, however, these species are difficult to germinate in the laboratory. This hinders conservation and restoration efforts for sand verbenas some of which are rare and others of which have been displaced from dune environments by the encroachment of invasive species and human activities. Several of the pretreatments used to enhance germination of *Abronia* species, e.g., stratification, act on ethylene biosynthesis in other taxa. Thus the possibility that ethylene (supplied as the liquid ethephon) could trigger germination was investigated for the perennial *Abronia martima* and the annual *Abronia umbellata*. Germination of achenes from which the anthocarp had been removed exceeded 90% for all concentrations of ethephon tested (10, 100, and 500 $\mu mol\ l^{-1}$) but the rate of germination was highest at 500 $\mu mol\ l^{-1}$. Ethephon treatment (100 $\mu mol\ l^{-1}$) also resulted in germination for *Abronia fragrans* and *Abronia villosa* suggesting that different sand verbenas may have similar dormancy mechanisms. Germination of achenes surrounded by the anthocarp is only slightly increased with ethephon treatment (approximately 10%) indicating a "coat-imposed" dormancy by the anthocarp. Identification of ethylene as a germination cue will facilitate conservation and restoration efforts for sand verbenas.

100. FIRES OF KELVIN CANYON

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The objective for this study was to determine the effects of a surface burn on the soil in Kelvin Canyon. Ten soil pits were dug, five affected by the burn and five relatively unaffected. Over two weeks multiple tests were run on the pits, including pH, drip test for hydrophobic layer, structure, drainage, and water retention difference. Differences in vegetation were also observed. Some of the tests revealed no statistically significant differences. Percent clay and water retention differences do not vary from burned to unaffected pits, and all sites are classified as well-drained. Soil pH in the surface horizon of burned soils is more alkaline than the surface horizon of unaffected soil. Another result of a burn is the formation of

a hydrophobic layer, formed when hydrophobic compounds in the soil secrete a waxy substance which coats soil particles. The hydrophobic layer is present in all burned pits, but absent in pits that were not burned. Sites that were not scorched have a higher percentage of native vegetation and more total percent cover than burned sites. Invasive annuals quickly colonized the burned areas, but perennial natives show some signs of recovery. Burned sites have darker colors in their surface horizon than unaffected sites. Structure is very similar in all horizons except the surface, where burned pits tend to have angular blocky shape and unaffected pits tend to be granular.

101. INFLUENCE OF ANTHROPOGENIC NOISE ON SONG STRUCTURE IN ANNA'S AND COSTA'S HUMMINGBIRDS

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Urbanization causes an increase in human-created (anthropogenic) noise, e.g. from traffic and power lines. This increased noise may be a problem in habitats where animals depend on sound transmission for survival and reproduction. Songbirds have been shown to raise the frequency of their song above ambient noise, however hummingbirds are not songbirds. Increased anthropogenic noise may interfere with the behavior of male hummingbirds, as they use song to defend their feeding and breeding territories and to attract potential mates. It is possible that hummingbirds are unable to alter their song in response to changes in noise levels, in which case anthropogenic noise could have a negative effect on hummingbirds[1] reproductive success. We analyzed the song of male Anna[1]s and Costa[1]s hummingbirds (Calypte anna and Calypte costae, respectively), to determine whether they alter song parameters (frequency, amplitude, power and duration) in response to increased ambient noise. We also looked at possible behavioral changes in the presence of sources of intermittent noise, such as cars.

102. THE EFFECTS OF HYDROPERIOD ON THE GROWTH RATES OF FLORIDA FLAGFISH, *JORDANELLA FLORIDAE*, IN THE FLORIDA EVERGLADES

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Ecologists often assume that certain environmental conditions are detrimental to the fitness of a species based on studies of other species occupying the same ecological niche. In order to determine the effects that environmental pressures impose upon a particular species, their life history parameters should be examined over a range of presumably favorable and unfavorable conditions. In this study, we examined the effects of hydroperiod on the growth rates of Florida flagfish, *Jordanella floridae*, in the Florida Everglades. Areas with short hydroperiods often force fishes and other aquatic organisms to emigrate to areas with longer hydroperiods in order to seek suitable habitat. The energy normally reserved for growth is thus expended on these seasonal migrations. In contrast, our data show that there is no significant relationship between hydroperiod and the growth rates of *J. floridae*. Additionally, we found that juveniles experience higher growth rates in Shark River Slough than in the Water Conservation Areas but slightly slower rates of growth after maturation. We conclude that hydroperiod has relatively little effect on *J. floridae* and believe that its tolerance of shallow depths, low oxygen levels, and crowded conditions allows this species to remain in or near areas that experience frequent dry-down events. This study illustrates the need to determine species-specific responses to presumably stressful environmental conditions.

103. GEOCHRONOLOGY AND PALEOENVIRONMENT OF PLUVIAL HARPER LAKE, MOJAVE DESERT, CALIFORNIA

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The Mojave River is a well-known recorder of Southern California paleoclimate with a complex paleohydrology and past terminations in pluvial (upstream to downstream) Harper (Harper basin only),

Manix (Afton, Coyote & Troy basins), Mojave (Soda & Silver basins) lakes over the last 30,000 years. Previous studies yielded uncalibrated radiocarbon ages ranging from 24 ka yrs B.P. to > 30 ka yrs BP for lake high stand deposits near 656 m elevation. Based on several studies, the Mojave River: 1) flowed simultaneously into Harper and Manix lakes ~30 ka; 2) flowed exclusively into Manix Lake 28–25 ka; 3) resumed simultaneous flow into Harper and Manix lakes, reaching the highstand and then receding ~25 ka. However, the radiocarbon dates do not encompass the complete section, thus the maximum age of Harper Lake is unknown. Here we present geologic mapping (1:12,000), a measured stratigraphic section and radiocarbon ages from the Red Hill area. The 2.1-m-thick continuous stratigraphic section is near the high-stand elevation and comprised of interbedded sand, silt and silty sand capped by a 0.6-m-thick sequence of carbonate mud. The base of the section nonconformably lies on quartz monzonite. Four *Anodonta californiensis* shell horizons were sampled for radiocarbon dating. Seven uncalibrated radiocarbon ages range from 29,210 ± 240 to 35,230 ± 490 ^{14}C yrs B.P. Our radiocarbon ages and the continuity of the section support a single Harper Lake highstand between 35 and 29 ka with no subsequent highstand at 25 ka.

104. POSSIBLE HEAT SOURCES FOR CRANIAL ENDOTHERMY IN THE YELLOWFIN TUNA

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Endothermic tunas can produce heat internally and conserve heat to elevate the temperature of the eye and brain above water temperature, a characteristic known as cranial endothermy. Although elevated cranial temperatures have been measured in tunas, the mechanism whereby heat is produced for cranial endothermy in these fishes is unknown. The purpose of this project was to test the hypothesis that the heat source is one or more of the six extrinsic ocular muscles in tunas. Ocular muscle samples from the yellowfin tuna (*Thunnus albacares*) and the chub mackerel (*Scomber japonicus*), an ectothermic scombrid fish, were obtained from fish collected off the coast of Panama and southern California. The relative mass of each muscle was measured and expressed as a percentage of total eye mass. The capacity for metabolic heat production in each ocular muscle was quantified by measuring the activity of the mitochondrial enzyme citrate synthase (CS). The medial rectus muscle was found to be the largest of the six ocular muscles in both species. There was no significant difference in CS activity among the six ocular muscles in the yellowfin tuna. The lateral rectus muscle in the chub mackerel had the highest CS value of all the ocular muscles, indicating a high heat production capacity. Overall, ocular muscle CS activities were higher in the chub mackerel than in the yellowfin tuna, but relative muscle masses were greater in the tuna. The results suggest that all six extra-ocular muscles may contribute to cranial endothermy in tunas.

105. CONTROLS ON PLANT GAS EXCHANGE ACROSS A GRASSLAND TO SHRUBLAND GRADIENT IN OWENS VALLEY, CALIFORNIA

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It has been suggested that woody encroachment is occurring in Owens Valley, California due to water stress caused by groundwater pumping and redistribution that has been occurring for the last hundred years. However, this linkage has not been solidly demonstrated. I tested the hypothesis that changes in water availability may facilitate irreversible woody encroachment by choosing sites along a vegetational gradient, from grassland to predominately shrubland. At each site I took chemical and isotopic composition measurements of plants and soil, ground and stem water isotopic measurements, and physiological measurements of the dominant species in each site. Grass gas exchange in the grassland site was high at the beginning of the season, while at the intermediate and shrubland sites grass gas exchange remained low and constant throughout the season. This difference was not attributable to groundwater use, water potential, or leaf carbon to nitrogen ratios. Soil organic content was greatest at the grassland site and the least at the shrubland site, and the soil nitrogen was most enriched at the shrubland site. In all species, leaf nitrogen loss was evident. Leaf carbon to nitrogen (C:N) ratios were greatest in the shrubland except for the halophytic shrubs, where leaf C:N did not differ between sites. Leaf nitrogen in the shrubs,

and especially in the halophytic shrubs, was more enriched than the grasses, suggesting that shrubs may be more competitive at taking up enriched soil nitrogen, possibly facilitating woody encroachment through a decline in grasses from sites with low and enriched nitrogen content.

106. THE EFFECTS OF GLYPHOSATE ON PROLIFERATION OF *RANA PIPIENS* SPLENOCYTES STIMULATED WITH CON A AND PHA

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The decline of amphibian populations, beginning in the 1970s, has become an area of major concern. Among the possible explanations for this worldwide decline, pesticide exposure has gained significant attention in recent years. Glyphosate (active ingredient in the herbicide Roundup^{TM}) is a herbicide that is frequently in many countries to control vegetation in both cropland and aquatic environments. The effects of glyphosate on the proliferation of *Rana pipiens* (Leopard frog) splenocytes stimulated with mitogens Concanavalin A (ConA) and Phytohemagglutinin-M (PHA) were studied. Splenocytes were exposed to 20 µg/ml of each mitogen and a range of 2.5 µg/ml to 5000 µg/ml of glyphosate. Cell counts were used to determine effects on proliferation. Our data show a consistent decrease in the number of splenocytes exposed to glyphosate, whether proliferation was stimulated by Con A or PHA. These results suggest that glyphosate can alter the immune response of leopard frogs.

107. 10-YEAR ASSESSMENT OF SOFT-BOTTOM MACROBENTHIC ASSEMBLAGES OFF THE COAST OF SAN DIEGO

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The City of San Diego has conducted regional benthic surveys of the continental shelf and slope off San Diego since 1994. The main objectives of these surveys are: (1) to characterize benthic conditions for the coastal region off San Diego; (2) to characterize the ecological health of the marine benthos in the area; (3) to gain a better understanding of regional conditions in order to distinguish between areas impacted by anthropogenic or natural events. The study area ranges from northern San Diego County south to the US/Mexico border. During the summers of 1994 through 2003 a total of 324 randomly selected sites were sampled at depths ranging from 9 to 461 m. Patterns of macrobenthic community structure and the distribution of various environmental parameters were addressed using a suite of univariate and multivariate statistics. Using these analyses we identified 10 main macrobenthic assemblages during this 10-year period. A combination of cluster mapping and ordination by MDS discriminated these assemblages as stratified along depth contours, with no apparent spatial patterns relative to point source inputs. Although results from the univariate analyses were variable, values were comparable to historical ranges recorded for the entire Southern California Bight. Overall, these data suggest that the structure of benthic communities off San Diego has remained stable and not changed substantially in recent years.

108. LENGTH, WEIGHT AND GENDER COMPARISONS OF THE BAY PIPEFISH (*SYNGNATHUS LEPTORHYNCHUS*) FROM THREE CENTRAL CALIFORNIA COASTAL LOCATIONS

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The bay pipefish, *Syngnathus leptorhynchus*, is commonly found in eelgrass beds along the Pacific coast from Alaska to Baja California. Despite numerous studies on its reproductive behavior, little is known about the size patterns of this species. This study examined the correlation between standard length and wet weight of this species from three locations along the central California coast, as well as the gender composition in each location. Individuals captured ranged from 52.75 mm to 270.82 mm in standard length, and from 0.13 g to 8.31 g in wet weight. Correlation tests revealed the standard lengths and wet

weights of the fishes in each location were significantly correlated. Average wet weight of females was slightly larger than average weight of males in all three locations. However, in two respective locations, average standard lengths of females were larger than males. In addition, the sex ratio was skewed towards females in these two locations; nevertheless, this is not sufficient to determine if males are in short supply in these locations.

109. PREDATION IN EELGRASS BEDS: DO TROPHIC MANIPULATIONS RESULT IN CASCADING EFFECTS?

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Eelgrass (*Zostera marina*), common to bays and estuaries in California, provides important nursery grounds to many fishes and invertebrates. Although much work has been conducted on this and other seagrasses, very little is known about ecosystem function via trophic interactions in nature that may ultimately impact the health of eelgrass. The aim of this project is to explore the importance of small microcarnivorous fishes in the functioning of eelgrass ecosystems. We are using caging experiments to manipulate predator density and diversity, and observe the responses of organisms at lower trophic levels. The proposed experiments will provide managers important information that may aid in the restoration and conservation of these declining essential fish habitats. In Summer 2006, 18 prototype cages were constructed and tested for use in predator manipulations. In addition, beach seines were used to evaluate the diets and relative densities of small carnivorous fishes common to eelgrass habitats within San Diego Bay. A pilot experiment was also completed testing the effectiveness of cage designs and sampling methods. Cages appear to generally be well designed; however, the mesh used (3 mm) exerted significant shading effects on seagrass. A new mesh has been employed that results in minimal shading while excluding most small fishes. Predator manipulation experiments are scheduled to be conducted in Summer 2007.

110. THE EFFECTS OF STRESS AND EXERCISE ON THE EXPRESSION OF BCL-2 ASSOCIATED PROTEIN X AND BRAIN-DERIVED NEUROTROPHIC FACTOR

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It was previously shown that chronic restraint stress induces an upregulation of activated Bcl-2 Associated protein X (Bax), which promotes neuronal apoptosis in its oligomer state. Exercise lowered levels of Bax, and it was hypothesized that this was due to elevation in trophic factor expression, in particular brain-derived neurotrophic factor (BDNF). BDNF, markedly expressed in the hippocampus of the brain, is a protein that serves as a neurotransmitter regulator and aids in long-term potentiation and learning. BDNF can also activate phosphatidylinositol 3-kinase, mitogen-associated protein kinase, and other cell survival pathways; it has the potential to protect against stress-induced harm in neurons. In the current study, rat models were subjected to acute stress by immobilization and/or allowed to exercise by a running wheel 14 days prior. Four treatment groups were compared: stress-only, exercise-only, exercise with stress, and control (with neither stress nor exercise). Cortical homogenates underwent non-sodium dodecyl sulfate polyacrylamide gel electrophoresis and western blotting for Bax, and hippocampal BDNF mRNA levels were analyzed via *in-situ* hybridization. No statistically significant differences were seen in the activated Bax levels. In the CA3 region of the hippocampus, the exercise-only group showed higher BDNF mRNA levels than did those of the stress-only group. Furthermore, the levels of BDNF in either the exercise-only or stress-only treatment were directly opposite the levels found of Bax found previously in a chronic stress study. These data suggest that BDNF plays some role in countering the harmful effects of stress.

111. FEEDING RATES OF NATIVE CONSUMERS ON INTRODUCED AND NATIVE SEAWEEDS ON URBAN SOUTHERN CALIFORNIA SHORES

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Understanding the impacts of non-indigenous species (NIS) is crucial to the development of management approaches designed to preserve marine biodiversity and ecosystem functioning. On many southern Californian shores, NIS of seaweeds are abundant and important contributors to community primary production. Yet, little is known about the roles of these NIS in intertidal food webs. To address this, we are conducting experimental studies to determine the attractiveness of NIS by comparing the feeding rates of native algal consumers in single-food trials on NIS and native seaweeds. Algal-eating, native consumers include the sea hare *Aplysia californica*, the snails *Lithopoma undosum* and *Tegula aureotincta*, the crab *Pachygrapsus crassipes*, and the urchin *Strongylocentrotus purpuratus*. We selected NIS of seaweeds with different periods of residency in local waters, including species: 1) with a >25 year history of population establishment (*Sargassum muticum* and *Lomentaria hakodatensis*), 2) that have appeared in the last 5 years (*Caulacanthus ustulatus*, *Sargassum filicinum*, and *Undaria pinnatifida*), and 3) have the potential to become invasive (*Caulerpa racemosa* and *Grateloupia turuturu*). Preliminary results suggest that feeding rates of native consumers are low for NIS of seaweeds relative to preferred native seaweeds. Currently, little is known about interactions between NIS of seaweeds and native consumers or how these consumers might be responding to shifts in food availability resulting from introduced species. We hope to improve understanding of the roles being played by NIS of seaweeds in intertidal food webs and shed light on ecosystem-level responses to seaweed introductions in urban southern Californian habitats.

112. PREDICTORS OF SUCCESSION IN A CHRONOSEQUENCE OF *IMPERATA* INFESTED COMMUNITIES

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Lowland tropical rainforests are rapidly disappearing due to fire, logging, and agriculture. Research and conservation efforts are urgently needed, especially in understudied areas like Borneo, Indonesia. Borneo is the world's third largest island and is part of the Sundaland Biodiversity Hotspot. It is also home to many endangered species, including orangutans, which further increases the ecological imperative to study this area. Succession and reforestation efforts in Southeast Asian rainforests have been hindered by the invasion of *Imperata cylindrica*, which is one of the ten worst weedy species in the world and often creates a fire climax community. Most research on *Imperata* control has focused on restoring the land to create commercial plantations. By contrast, little research has been done on natural succession in *Imperata* grasslands or on restoring these grasslands to secondary forest. For this study, plots have been established in a chronosequence of *Imperata* infested sites in Tanjung Puting National Park in Central Kalimantan. It will be determined if land-use and fire history are good predictors of succession in these communities. Also, some plots have been planted with indigenous tree species using different reforestation methods to assess their potential in preventing temporary suppression or permanent deflection of succession. Plots will continue to be monitored for seedling survival and plant cover change. Additionally, climate data and GIS and remote sensing will be used to assess spatiotemporal patterns and to predict future land-use change on a regional basis.

113. THE EFFECTS OF SODIUM BUTYRATE ON THE ORGANIZATION OF ACTIN FILAMENTS IN U87MG BRAIN TUMOR CELLS

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Actin is an important biological component of the cell and is responsible for cell structure, division and motility which is crucial in cancer cell metastasis. This study examines the effects of sodium butyrate (NaB) on actin filament organization of U87MG brain tumor cells. Two treatment groups, cells treated with NaB for 5 days (5 dB) and cells treated chronically with NaB for longer than 12 days (ChB), were compared to an untreated control group (NoB). All three groups were prepared for fluorescent microscopy by using 4% paraformaldehyde to fix the cells. First, it is necessary to fix the cells in order to protect them from damage caused by reagents used throughout the staining procedure. Next, the cells were permeabilized with the detergent 0.1% Triton X-100. Oregon Green phalloidin in Phosphate Buffered Saline, containing 1.0% bovine serum albumin used as a blocking agent to reduce non-specific binding,

was used to stain the cells for 20 minutes at room temperature. The cells were then mounted onto a slide and viewed using a Nikon Eclipse E400. The results indicated that overall cell shape was affected in the two treatment groups when compared to the control group. 5 day NaB treated cells showed degeneration of cell structure and cell-cell contacts, while the chronically treated cells maintained prominent cell processes and structure as seen by long, invasive projections. This is important in the study of cancer cell metastasis because degenerative cell structure and cell-cell contacts could allow cells to travel farther whereas cells that have invasive projections are anchored down and are unable to migrate. The role of actin in the cell processes are still under investigation. (This research was supported by a grant from the Ryckman Endowment Student Research Fund at La Sierra University)

114. HYPOCHLORITE-INDUCED DEATH REVEALS THAT MICROPYLAR CELL DIVISION IS NOT NECESSARY FOR DEVELOPMENT OF *SPATHOGLOTTIS PLICATA* SEEDLINGS

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During embryogenesis in flowering plants, the embryo typically develops with a distinct shoot/root axis. In contrast, embryos of seed from the orchid, *Spathoglottis plicata*, tend to show vague indication where the shoot apex is located. It seems that smaller cells located at the proximal/chalazal end of the embryo designate the shoot apex, although it is unclear whether cells in the distal/micropylar region also play a role in seedling establishment. In this work, we show that exposing the micropylar region of the orchid seed embryo to high levels of chlorine will cause death of the embryo and result in bright green autofluorescence. However, lower chlorine treatments will partially affect the embryo, leaving a fluorescent stub in the seedling. Preliminary growth data suggests that this region is not going through cell division. Thus in *Spathoglottis plicata*, micropylar embryonic cells may not be required for increased cell mass during seedling development.

115. THE EFFECTS OF AN INVASIVE PLANT SPECIES, *VINCA MAJOR*, ON ARTHROPOD COMMUNITIES IN RIPARIAN HABITAT AT STARR RANCH AUDUBON SANCTUARY, CALIFORNIA

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Terrestrial arthropods play important roles as decomposers, nutrient recyclers, herbivores, predators, and pollinators. Invasive plants can alter the biodiversity of habitats and arthropods are especially sensitive to such changes. The plant *Vinca major* is an invasive species in southern California and is particularly successful in riparian areas. Understanding how invasive species affect arthropods is important in maintaining biodiversity and the structure of native ecosystems. In this study, we examined the impact of *V. major* on arthropod communities. We hypothesized that arthropod abundance and species richness would be impacted by *V. major* because of changes in the composition in the plant community and the associated changes in habitat structure. Arthropod abundance and species richness were measured along a riparian habitat in non-invaded sites and sites invaded by *V. major* at Starr Ranch Audubon Sanctuary in Orange County, California. Over the course of 36 hours, terrestrial arthropods were captured using 9 pitfall traps in 3 m $\times$ 3 m plots (6 sites total). We categorized arthropods into morphospecies, species identification based on morphological similarities, and counted the number of individuals of each morphospecies. We also identified the order of each morphospecies. There were significantly more orders of arthropods from non-invaded sites compared to invaded sites. However, arthropod abundance was generally higher in *Vinca*-invaded sites. These results indicate that non-invaded sites have a greater diversity of arthropods while invaded sites have lower diversity with higher abundance. This supports the hypothesis that invasive plants can alter arthropod communities.

116. THE POPULATION GENETICS OF ROUND STINGRAYS FROM SOUTHERN CALIFORNIA ASSESSED BY MICROSATELLITE MARKERS

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This study aims to determine whether the genetic population structure of round stingrays (*Urobatis halleri*) near a warm water outfall in Seal Beach, CA shows either seasonal or annual variation. It also aims to elucidate if a homogeneous population structure exists in the Southern California Bight, utilizing samples that have been collected from the Seal Beach Naval Weapons Station wetlands and San Diego Bay, CA. Highly polymorphic STR primer pairs have been developed for four loci, and analysis is nearly complete for one locus, Uha 170. This locus shows no variation over seasons or over 5 years ($F=0.7221$, $p=0.6534$) at Seal Beach. Partial analysis of the Weapons Station and San Diego samples indicates similar allele distributions to that of Seal Beach suggesting a large, homogeneous population. Primary data from the other three loci thus far show similar results to the Uha 170. Tissue samples from round stingrays found across geographic barriers (north of Point Conception, the Gulf of California, and Santa Catalina Island) are also currently being collected and will be tested to determine if they display different allelic frequencies to those found in the Southern California Bight.

117. FEEDING PREFERENCES OF THE MARINE GASTROPOD *APLYSIA VACCARIA*

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Herbivores can exert a large impact on algal community structure. Understanding herbivore feeding preferences provides insight into their relative importance in structuring their communities. *Aplysia vaccaria* is a large herbivorous marine gastropod found along the California coast. Little is known about this species regarding its feeding ecology due to its temporally and spatially patchy distribution. To determine if *A. vaccaria* exhibits feeding preferences, we performed a series of paired-choice feeding trials. The algae used include two brown kelps commonly found in its habitat, *Egregia menziesii* and *Macrosystis pyrifera*, along with the red algae *Plocamium cartilagineum*, which is a primary food source for its cousin *A. californica*. We hypothesized that *E. menziesii* would be preferred over other algal species because it is prevalent in *A. vaccaria's* habitat and is thought to induce larval metamorphosis. After feeding trials, we analyzed for preferences by comparing differences in the amount (g) of algae consumed using paired t-tests. *E. menziesii* was significantly preferred over *P. cartilagineum*, while there was no significant difference in consumption between *E. menziesii* versus *M. pyrifera*. Additional feeding trials will be conducted using all combinations of the above algal species paired with *Ulva californica* and *Laminaria farlowii*. Studying the feeding ecology of *A. vaccaria* may determine its importance as a grazer as well as any disturbances it may create in marine algal communities.

118. INDUCED OXIDATIVE STRESS DECREASES MINERALIZATION IN BONE-LIKE CELL CULTURES

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The maintenance of appropriate bone mass is critical in sustaining optimum bone health. Many factors such as hormones, diet, genetics and oxidative stress influence bone mass and mineralization. Osteoporosis is a bone disorder characterized by thinning of bone mass with a reduction in calcium and bone proteins. It is well known that oxidative stress induces apoptosis in many cell types. This compromises the ability of specific bone cells (osteoblasts) to mineralize properly. Cellular mechanisms leading to the response of osteoblasts to oxidative stress and subsequent decrease in mineralization are incompletely understood. This study investigates the effect of camptothecin, a known oxidative stressor and inducer of apoptosis, on mineralization in an osteoblast-like cell line, UMR 106-01 BSP (UMR cells). UMR cells are rat osteosarcoma cells that exhibit many of the morphological and physiological characteristics of primary osteoblasts, including the production of the enzyme alkaline phosphatase. This enzyme is essential in the mineralization of a bone-like matrix secreted by osteoblasts *in vitro*. When UMR cell cultures were treated with camptothecin, they showed a concentration-dependent decrease in mineralization that correlated with a decrease in alkaline phosphatase concentration. These findings suggest that oxidative stress negatively impacts bone mineralization and general bone health. Further studies are necessary to elucidate the cellular mechanisms involved in osteoblastic responses to oxidative stress and to identify countermeasures can be employed to mitigate decreased mineralization.

119. COMPARISON OF THREE ANALYTICAL METHODS TO DETERMINE CHLOROPHYLL CONCENTRATION IN THE OCEAN

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Understanding variations in phytoplankton abundance is an important aspect of ocean monitoring. Variations can indicate algal blooms, which can be toxic and affect the health of humans and wildlife. Chlorophyll concentrations are commonly used to monitor these changes. Sensors are now available that measure chlorophyll concentrations in real-time, enabling an accelerated ability to recognize harmful algal blooms. CICORE is involved in an effort to monitor water quality variations, including chlorophyll, in real-time along the California coast via in-situ sensors. Our purpose was to compare High Profile Liquid Chromatography (HPLC) and fluorometry to enable a more accurate interpretation of the data set obtained by our sensor. A Turner Bench top 10-AU Fluorometer, a Beckman HPLC system, and a Turner Chlorophyll a in-situ sensor were used to examine water in Fish Harbor, Terminal Island. Side-by-side comparisons supported the literature in concluding that all three methods provided a qualitative, not quantitative, measurement of chlorophyll concentrations. Additional experiments focused on the interference of degradation products, and sample storage and extraction methods. Degradation products could be minimized in bench top fluorometry by acidification, were accounted for in HPLC (Yacobi, 1996), and were unaddressed by the in-situ sensor. Storage method showed that the rate of degradation varied depending on storage method. Extraction experiments showed that residual chlorophyll remained in the filter and further experimentation to determine more effective extraction should be performed. These results emphasize the importance of establishing standard methodology for analyzing and reporting chlorophyll concentrations so data can be comparable across regions and states.

120. COMMUNITY STRUCTURE OF MACROPARASITES OF THE VERMILION ROCKFISH, *SEBASTES MINIATUS*, FROM RECREATIONAL FISHING CATCHES OF SAN QUINTÍN, BAJA CALIFORNIA, MEXICO

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The vermilion rockfish, red rock cod or named simply "reds", *Sebastes miniatus* (Jordan and Gilbert 1880), is a common fish species that is caught from, both, the coastal commercial and the recreational fishing from California and northern Baja California. We studied the macroparasites (ecto and endo) from the vermilion rockfish that was captured by the recreational fishing from San Quintín, Baja California, México. Six bimonthly collections were realized during 2005, and 213 vermilions rockfishes were analyzed (Average 436 mm LT ± 68.9 SD, size interval 280–610 mm). All vermilions were parasited with one or more parasites. A number of 29,639 individuals of parasites were collected belonging to 12 species ranging in prevalence from 3.4% (*Clavella* sp) to 97% (*Megalobenedenia* sp) and 98% (*Clavellisa* sp). The most abundant parasite was *Botriocephalus* sp with 14,879 individuals; *Hysterothylacium* sp was second with 6,373 individuals, and followed by *Microcotyle sebastes* with 2,766 individuals. In same order, these parasites were present in 17.2%, 31.5%, and 18.2% of the total vermilion rockfishes. The mean intensity of individual parasite species on *S. miniatus* ranged from 0.1, *Pseudoterranova* sp to 425.1, *Botriocephalus* sp. The range of intensity of the parasite *Hysterothylacium* sp was from 1 to 2,231 individuals on a single fish.

121. TEMPORAL AND SPATIAL VARIATION IN SETTLEMENT OF *OSTREA CONCHAPHILA* IN NEWPORT BAY, CALIFORNIA

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Ostrea conchaphila, is the only oyster native to the west coast of the United States. Over-harvesting in the early 1900s paired with pollution from pulp mills led to massive population crashes. There are still remnant populations throughout its range and some restoration efforts are currently occurring in areas between northern California and Washington. Before planning to restore populations of *O. conchaphila*, it would be important to learn about constraints on current population growth. For example, knowledge about temporal and spatial variation of *O. conchaphila* larval settlement could potentially help maximize the collection of spat in order to enhance settlement within an existing population. Settlement of *O. conchaphila* was assayed at six sites throughout the bay using settlement tiles that were collected every spring tide. We hypothesized that settlement would vary both spatially and temporally among populations located within Newport Bay, California. Preliminary findings show that settlement varied significantly among sites, with highest settlement typically occurring at sites in the upper bay. We also found that settlement varied temporally with maximal settlement occurring in mid-August at most sites. Future studies will attempt to pinpoint variation in growth rates and survivorship among settlers from sites throughout Newport Bay in an effort to understand what factors limit population density.

122. THE EFFECTS OF SODIUM BUTYRATE ON U87MG BRAIN TUMOR CELL MIGRATION AND INVASION

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Differentiation drugs influence tumor cell behavior. They decrease proliferation and change the types of matrix metalloproteinases secreted by cells. This study investigates the effects of one differentiation drug, sodium butyrate (NaB), on the migration and invasion of U87MG brain tumor cells. Two treatment groups, cells treated with NaB for 5 days (5 dB) and cells treated chronically with NaB for longer than 12 days (ChB) were compared to an untreated control group. Migration was studied using a wound assay where the migration rate of cells into the wound area was measured. Preliminary wound assays show that of the three cell groups, the 5 dB cells had the highest migration rate while ChB cells had the lowest migration rate. Invasion was studied using a Transwell Invasion assay where cells must migrate through 8 um pores of a membrane insert (Becton Dickinson) containing 0.2 mg/ml Collagen I . The results of preliminary invasion assays indicate that 5 dB cells have a higher invasion rate relative to control and ChB cells when passing through a collagen I barrier. These studies suggest that chronic treatment with NaB may help suppress tumor metastasis however further studies are needed to understand the increased migration and invasion caused by NaB after 5 days of treatment. (This research was supported by a grant from the Ryckman Endowment Student Research Fund at La Sierra University)

123. ANTHROPOGENIC CONTROLS OF HARMFUL PHYTOPLANKTON TAXA IN SANTA MONICA BAY

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Anthropogenic alterations of coastal waters due to wastewater discharge and surface runoff cause shifts in phytoplankton biomass, productivity, and community structure. We present data that reveal dramatic increases in production and a shift to a harmful species, *Lingulodinium polyedra*, following the release of secondary effluent to surface waters of Santa Monica Bay. Further, we introduce a framework to test the mechanisms by which phytoplankton communities are altered in nutrient-rich freshwater plumes, with a particular emphasis on stormwater. This work highlights the role of coastal development in the dynamics of harmful algal blooms and the importance of improving management of wastewater and urban runoff.

124. EFFECT OF TEMPERATURE AND RATION LEVEL ON THE GROWTH OF YOUNG-OF-THE YEAR COHO SALMON (*ONCORHYNCHUS KISUTCH*): A COMPARISON BETWEEN OREGON AND CENTRAL CALIFORNIA STOCKS

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Coho salmon (*Oncorhynchus kisutch*) range from Scott Creek, Santa Cruz County, California to Alaska, across the Bering Sea and down to northern Japan. The Scott Creek (37°N) population constitutes the southernmost coho population in North America and is listed as endangered under the Endangered Species Act. We tested the effect of water temperature and ration level on the growth rate of these fish compared to a more northern population from the Salmon River, Oregon (45°N) grown under the same conditions. Fish were reared at 8, 12, and 17°C for two months at a ration level of either 1% or 2% of total tank biomass. Fish were weighed and measured every two weeks and rations were adjusted upwards at this time. Based on the water temperatures these fish experience during their first year in the stream we hypothesized that the Salmon River coho would grow better at 8°C; both stocks would grow equally at 12°C; and Scott Creek fish would grow better at 17°C. Our results show that the Salmon River coho grow better at all temperatures and ration levels than the Scott Creek coho.

125. PERCENT METHYLATION AND ITS RELATIONSHIP WITH AGING

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Aging, tissue deteriorating over time was evaluated using DNA methylation, a level of control, which regulates gene expression by adding a methyl group to cytosine, one of the bases of DNA. By measuring the DNA methylation patterns from the human hair follicle and buccal cells in the CpG islands of the CSX gene, it is hypothesized that as aging develops, there are numerous incorrect gene expressions causing an increase in DNA methylation patterns. Thus, the goal of this study is to determine an individual's age by calculating the percentage of methylation found in DNA of patient hair strands and in buccal cells. Using bisulfite treatment, which is necessary to determine the presence of DNA methylation, unmethylated cytosine is converted into uracil in the extracted DNA. DNA extracted from hairs and buccal cells were amplified by PCR and cloned for reading. Results for hair show inconsistency in DNA methylation patterns for age groups, while results for buccal cells remain inconclusive.

126. DETERMINING THE TIMING AND OFFSET OF SECONDARY NORMAL FAULTS IN THE KIT FOX HILLS ADJACENT THE NORTHERN DEATH VALLEY FAULT ZONE

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The Kit Fox Hills of Death Valley National Park California are composed of late Tertiary and Quaternary sediments uplifted by folding and faulting along the right-lateral Northern Death Valley Fault Zone (NDVFZ). Along the NDVFZ are arcuate normal faults that extend away from the fault at ~45 degree angle, and then parallel the fault zone. The purpose of this paper is to determine the offset and age of these normal faults by the morphological degradation. Three fault scarp faces were examined and their profiles measured. Two of the three were found to have a maximum angle less than the angle of repose and thus amenable to the Bucknam and Anderson method. Scarp 1 was found to be between 6–8 ka and scarp 2 plotted a range of 800 years – 1.5 ka. The third fault scarp has a 62 degree scarp face indicating either a relatively young scarp or high cohesion, carbonate-cemented soils. Machette (Machette 2001) found a scarp in Death Valley that is between 500–600 years in age. Scarp 3 is the only scarp in the Kit Fox Hills with a free face and may be a result of cemented soils. With too many variables attached to scarp 3, finding a relative age will have to remain undetermined. In doing this investigation it will greater our understanding of secondary fault ruptures along fault zones, which could improve the safety of buildings near faults as well as providing insight of the tectonics of the Death Valley fault region.

127. DEVELOPMENT OF JAW MUSCULO-SKELETAL STRUCTURE IN THE YELLOWFIN TUNA AND THE EASTERN PACIFIC BONITO

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The purpose of this study was to describe and compare the development of the jaw muscles and skeletal structure in larval yellowfin tuna (*Thunnus albacares*) and eastern Pacific bonito (*Sarda chiliensis*). The

bonitos (42.5–210.5 hours post spawning) were obtained from the Monterey Bay Aquarium and were raised at 24°C. Yellowfin tunas (24–445.5 hours post spawning) were raised at 27°C at the Inter-American Tropical Tuna Commission Achotines Laboratory in Panama. Immunohistochemical staining of slow muscle myosin and fluorescence and confocal microscopy were used to detect muscles in the jaw region. The development of the jaw skeleton was examined using samples that were cleared and stained, so that cartilage stained blue and bone stained red. The jaw was predominantly composed of cartilage up to 96 hours post spawning in larval yellowfin tuna and up to 162 hours post spawning in the bonito. Generally, yellowfin tuna developed at a faster rate than the bonito, in part due to the differences in water temperature, and ossification of the cartilage within the jaw region is also more rapid. During development, the jaw musculature increased in size in both species, but the lower jaw muscles were more extended and pronounced in the eastern Pacfic bonito compared with the yellowfin tuna. Because jaw musculo-skeletal structure affects feeding effectiveness, this study will lead to a better understanding of feeding and survival in the critical larval stage.

128. MORPHOLOGICAL VARIATION OF *YUCCA BREVIFOLIA* (AGAVACEAE) AMONG SEVEN POPULATIONS IN THE MOJAVE DESERT

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The current distribution of *Yucca brevifolia* Engelm. forms a disjunct ring around the Mojave Desert. which may represent the result of post-glacial migration that now restricts gene flow between eastern and western populations. We examined the tree and leaf morphology of seven populations of *Yucca brevifolia* spanning the Mojave Desert. Two taxonomic varieties, *Y. brevifolia* var. *jaegeriana* and *Y. brevifolia* var. *brevifolia*, are commonly distinguished based on general morphological characteristics including tree and leaf sizes. Morphological variance among populations was expected to be minimal within eastern or western regions, while variance between regions was expected to be greater. Key taxonomic characteristics were compared among populations using ANOVA, and broader evaluation utilized principal component analyses. Tree and leaf characters of three populations conformed to the classification of *Y. brevifolia* var. *jaegeriana*; one population showed characteristics of var. *jaegeriana* for leaf characters but not for trunk size, and three western populations exhibited characters similar to the more widespread *Y. brevifolia* var. *brevifolia*. Principal component analysis showed a clear separation in morphology between populations in the western and eastern regions of the desert. Climate variables did not correlate with morphological traits, suggesting that these morphological patterns may be a result of gene flow rather than common climate factors.

129. THE ACETYLCHOLINESTERASE INHIBITOR MALATHION IS NOT TOXIC TO THYMOCYTES, BUT MAY ALTER THE DEVELOPMENTAL PROGRAM AT LOW DOSES

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The incidence of allergy and asthma among children under five years old has risen 150% in the last two decades, and environmental pollutants are suspected to be contributors to this rise in incidence. Environmental pollutants, such as pesticides, are known to have a negative impact on the environment as well as many living organisms. However, there are a limited number of studies that have investigated the impact pesticides have on the immune system of mammals. Futhermore, even fewer studies exist that examine the impact of environmental toxicants on the immune system of the developing embryo and young animal, though the immune systems of the young are more vulnerable to perturbation than that of adults. Therefore risk assessment studies addressing fetal immune development are important tools for better understanding whether pesticides and other environmental toxicants contribute to immune system diseases that are widely common today. We set up an in vitro model system to assess the risk of exposure to the pesticide Malathion. Malathion was chosen for the study because of its widespread use in agriculture and the known role it plays as an acetylcholinesterase inhibitor. We analyzed the response of day 16–18 embryonic thymocytes to varying concentrations of Malathion. We hypothesized that greater concentrations of the pesticide would have a greater toxicity in T cells. Flow cytometric analysis was used to determine the level of toxicity and maturation of the embryonic T cells following culture.

130. EFFECTS OF METHOXYCHLOR EXPOSURE ON THE DEVELOPMENT OF CD4 T-CELLS IN C57BL/6 MICE

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T cells, one of many cell types comprising the immune system, protect the body from pathogens and diseases by initiating and orchestrating the adaptive immune response. T cells express one of two main types of co-receptors, CD4 and CD8. Before 1997, researchers were unable to study the development of T cells in the absence of the thymus, a lymphoid organ where T cells develop. However, Cibotti et al. (1997) found specific surface molecules (CD2 & TCR) that were able to signal immature T cells to become mature T cells in the absence of thymic epithelium. The goal of this project was to study the effects of methoxychlor (MXC) on the development of T cells using this *in vitro* model of T cell differentiation. MXC is an organochlorine pesticide adopted for use as a safer alternative to DDT, when DDT was banned. MXC is of particular concern because it mimics estrogens and acts as an endocrine disruptor. Previous studies have investigated the toxicological effects of MXC exposure and have found negative effects on the nervous and reproductive systems. Few studies, however, have been conducted investigating the effects of MXC on the development of the immune system, even though exposure to estrogens has been shown to reduce the number of T cells in the thymus (Barr et al., 1982). In agreement with studies of estrogen, we found that MXC did not appear to induce death of developing T cells (Zoller and Kersh, 2006), but rather to alter the T cell developmental program.

AJV is an undergraduate researcher.

131. COMPUTATIONAL ANALYSIS OF GRAINYHEAD-LIKE EPITHELIAL TRANSACTIVATOR (GET1) REGULATED GENES

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Grainyhead-like epithelial transactivator (Get1/Grhl3) is a conserved mammalian homolog of Grainyhead, which plays an important role in the cuticle development in Drosophila. It has been shown that Get-1 plays a critical role in the terminal differentiation of the skin epidermis and is essential for barrier function in mice. Microarray gene expression analysis of Get-1 knockout mice indicates that it regulates a broad array of epidermal differentiation genes encoding structural proteins, lipid metabolizing enzymes and cell adhesion molecules. In order to identify the direct target genes of Get-1, we looked for potential Get-1 sites conserved in the upstream, downstream and intronic regions of mouse and human genes using the ConSite program. Only those genes that had conserved sites in larger conserved regions were considered for further analysis. We considered only those sites that were also present in significantly conserved regions. We analyzed the top fourty differentially expressed genes from the microarray data. Get-1 binding sites were found in eight upregulated and sixteen downregulated genes, indicating that Get-1 directly regulates some genes involved in epidermal differentiation. The fact that both up and downregulated genes contain Get-1 binding sites suggests that Get-1 can both activate and repress transcription.

132. THE EFFECTS OF SODIUM BUTYRATE ON THE SECRETION OF MATRIX METALLOPROTEINASES BY U87MG BRAIN TUMORS

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Matrix metalloproteinases (MMP) are digestive enzymes that, when expressed and secreted by the cell, break down the extracellular matrix. The secretion of MMPs by cancer cells is associated with the process of metastasis. Studying the types of MMPs secreted by cancer cells can give insight into the initiation of metastasis. In this study, a 24-hour sample of MMPs secreted by untreated U87MG cells or cells treated with 2 mM Sodium Butyrate (NaB) for up to eleven days was collected daily into serum-free media. After centrifugation of the serum-free media, secreted MMPs were collected from supernatant. In preparation

for separation of MMPs by gel electrophoresis, non-reducing sample buffer was added to the samples of MMPs collected. The gel electrophoresis was run for 1 hour. The gel was incubated at 40 degrees Celsis in 2.5% triton x-100 for 30 min and 50 mM tris pH 7.8 10 mM $CaCl_2$ for 24-hours to digest the MMPs from the gel. The gel was then stained with 0.5% Coomassie Blue/ 30% Isopropyl/ 10% Acetic Acid and destained with 25 g/500 ml $(NH_4)_2SO_4$, 5% Acetic Acid. When comparing separation of MMPs through gel electrophoresis, the MMPs secreted from cells treated with NaB had an additional enzyme band that was not seen in the protein separation of MMPs secreted from untreated cells. It was determined that treatment of cells with NaB secreted an additional MMP otherwise not seen in untreated cells. (This research was supported by a grant from the Ryckman Endowment Student Research Fund at La Sierra University)

133. EXPERIMENTAL RESTORATION OF THE ROCKY INTERTIDAL BROWN ALGA *SILVETIA COMPRESSA* ON URBAN SOUTHERN CALIFORNIA SHORES

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Coastal communities in urban southern California are being altered by anthropogenic disturbances and climate change. Studies indicate shifts in rocky intertidal macrophytes from large, fleshy, highly productive seaweeds towards a less productive flora dominated by crustose algae and disturbance-tolerant, turf-formers. Of particular concern is the widespread decline of the mid-intertidal alga *Silvetia compressa*, an important canopy-forming seaweed that harbors a diverse assemblage of organisms. Restoration has been successful in the re-establishment of ecologically important species in many terrestrial and estuarine habitats but has rarely been attempted on rocky shores. The goal of this study is to experimentally investigate methods of restoring *Silvetia* on southern California shores and to examine two factors known to significantly affect early post-settlement survivorship in this species: canopy protection and grazer activity. A two-way factorial design is being used with simulated plexi-glass canopy and herbivore exclusion (anti-fouling paint) treatments applied to two "seeding" methodologies: 1) bags containing fertile receptacles and 2) transplantation of juvenile thalli (<2.5 cm diameter). Experiments are being carried out at four study sites, three of which now support no or very little *Silvetia* cover. Preliminary results suggest that simulated canopy and herbivore exclusion treatments enhance survivorship of transplanted *Silvetia* juveniles. However, to date attempts to establish juvenile thalli from transplanted fertile receptacles have been unsuccessful. This study will provide insight into the feasibility of restoring ecologically-important rockweeds in disturbed intertidal habitats, and also will improve understanding of how early life history stages of seaweeds respond to stressors on southern California shores.

134. SPATIAL AND TEMPORAL VARIATION IN $\delta^{13}C$ AND $\delta^{15}N$ VALUES OF MACRO-ALGAE IN SOUTHERN CALIFORNIA WATERS

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Stable isotopes are useful tools for assessing the sources of nutrients to macro-algae and the contributions of macro-algal-derived production to benthic consumers. Despite the increasing use of stable isotopes in analyzing the roles of macro-algae in coastal communities, few $\delta^{13}C$ and $\delta^{15}N$ values are available for southern California seaweeds; additionally, variation among and within species over space and time is not well understood. Herein, we report $\delta^{13}C$ and $\delta^{15}N$ values for seven southern California seaweed species, including representatives from the divisions Chlorophyta, Phaeophyta, and Rhodophyta. Seaweeds were collected from two sites during winter and summer to examine spatial and temporal variation in their isotopic signatures. As expected, mean $\delta^{13}C$ values of the tested macro-algae varied within and among species (−19.1 to −13.4‰), irrespective of the division to which they belonged, and were clearly differentiated from published reports for phytoplankton and other coastal production sources. Macro-algal mean $\delta^{15}N$ values were similarly variable (8.4 to 10.3‰), but were enriched compared to $\delta^{15}N$ values reported for macro-algae inhabiting other temperate waters. Six species showed small, but statistically significant differences in $\delta^{13}C$ and four species in $\delta^{15}N$ values between sites and/or

sampling periods. Macro-algal $\delta^{13}C$ signatures did not show a spatial or temporal trend; in contrast, enriched $\delta^{15}N$ signatures were detected during the winter sampling period for six of seven species regardless of site. More data are needed to improve understanding of spatial and temporal variation in $\delta^{13}C$ and $\delta^{15}N$ signatures of seaweeds in southern California waters.

135. HEAT SHOCK PROTEIN 70 (HSP70) EXPRESSION IN MULTIPLE SCLEROSIS

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Multiple Sclerosis is an autoimmune disease of the central nervous system which results in significant areas of demyelination, caused by the immune system attacking myelin. There are three main neural lineage cell types in the brain: neurons, which process and transmit signals all over the body; astrocytes, which ensure homeostasis and affects neuronal activity in the brain; and oligodendrocytes, which form them myelin-sheaths around nerve cells. Heat shock proteins (Hsp) are essential to the everyday survival of cells because they protect all cellular proteins following stress by binding to and ensuring they retain their shape and activity. Hsp can also work as immune stimulators, taking these cellular proteins to the immune system and causing increased immune responses to these proteins. The purpose of my project is to do a two-colored staining of a neural cell and Hsp70 to see which cells are stressed, and overexpressing Hsp70. Using polyacryalmide gel electrophoresis, we determined the capacity of different primary antibodies specific for GFAP (astrocytes), MAP2 (neurons), OSP (oligodendrocytes) and Hsp70 (Heat Shock Protein 70) to recognize proteins in human brain tissue homogenates. The data also show that using immunofluorescence, I could successfully identify the three different lineages of neural cells in the tissues (neurons, oligodendrocytes, astrocytes). The staining for the Hsp70 however did not provide any significant results, even though the antibody recognized proteins in human brain homogenates. Thus double staining with Hsp70 and neural cell antibodies was not feasible. I will try alternate antibodies specific for Hsp70 in future work.

136. A STUDY OF FECAL INDICATOR BACTERIA IN THE BALLONA WETLANDS AND DEL REY LAGOON, LOS ANGELES, CALIFORNIA

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Wetland areas and beaches adjacent to them are a great concern due to their interaction and the presence of sources of fecal contamination. The purpose of this study is to compare densities of fecal indicator bacteria (FIB) in tidal water flowing in two adjacent aquatic ecosystems, the Ballona Wetlands and Del Rey Lagoon. During four surveys in 2005, each site was sampled during ebb tide flows of spring low tides. Samples were collected inside the Ballona Wetlands and in Del Rey Lagoon. At each site, water quality measurements (temperature, salinity, dissolved oxygen, pH) were made using a YSI 600R Sonde, five replicate samples of water were collected for turbidity (HACH 2100N turbidimeter) and FIB determinations and counts of birds feeding or resting on nearby intertidal mudflats were made. Samples were tested for total *Coliforms* and *E. coli* using the IDEXX defined substrate test kits (Quanti-Tray 2000 test trays, Colilert-18 media). Bacteria were further characterized using the API 20E Identification System for *Enterobacteriaceae*. *E. coli* densities were greater in water flowing from the lagoon compare to the wetlands on three occasions, two of which were significantly different ($p<0.05$). The Del Rey Lagoon was observed to have higher concentrations of water fowl than seen in the main channel of the Ballona Wetlands, so the greater *E. coli* densities in the lagoon may be associated with greater bird densities. Based on the metabolic responses indicated by the API system, the *E. coli* measurements obtained using the IDEXX system may represent a variety of *Enterobacteriaceae* species.

137. GEOGRAPHICAL, TAXONOMICAL, TEMPORAL AND HOST SIZE/AGE COMPARISONS OF INTESTINAL PARASITES IN THREE SPECIES OF SCULPINS

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This study investigates three species of tidepool cottids, *Oligocottus maculosus*, *O. snyderi*, and *Artedius notospilotus* that often serve as definitive hosts for digenic trematodes. Analysis of parasite prevalence and mean intensities between the species showed that infection was neither geographically nor taxonomically selective. Also, in *A. notospilotus* and *O. maculosus* the numbers of parasites increased as the size of the host increased, implicating that both species are infected by parasites throughout its lifetime. *O. snyderi* showed no increase in parasites as the size of host increased, suggesting that it is parasitized only as a juvenile. In comparison with previous MBQ studies, there was no significant change in the mean intensity of *O. snyderi* and *O. maculosus* and in the percentage of parasitized individuals of *O. snyderi*.

138. A TAXONOMIC REVIEW OF LATE CRETACEOUS CIMOLESTIDS

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Cimolestids, late Cretaceous mammals known primarily from western North America, are hypothesized to include the origins of Carnivora as well as other placentals. This relationship is based on their biostratigraphic position, within late Cretaceous and early Paleocene (70–64 mya) sediments, as well as the carnassial-like occlusion of their dentition. Current taxonomic relationships of cimolestids are based almost entirely on tooth morphology, and remain largely unresolved. The last major taxonomic study of cimolestids was done in 1973, and our knowledge of early eutherians and the number of specimens collected has more than doubled since then. The methods utilized for analyzing the phylogenetic relationships between taxa has also advanced dramatically.

Even in recent studies of early eutherians, cimolestids are often referred to as a single taxon, providing little detail as to how the known species are related to one another and to other eutherians. The purpose of this study is to examine the known late Cretaceous cimolestids using modern techniques to study their phylogenetic relationships amongst themselves and to earlier eutherians. One cimolestid in particular, *Procerberus*, is of special interest because of its uncertain relationship to *Cimolestes*. Preliminary morphological analyses suggest that it groups within *Cimolestes*, requiring a taxonomic revision of this clade.

139. PRELIMINARY REVISION OF AGRIOCHOERID OREODONTS OF SOUTHERN CALIFORNIA

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Oreodonts are an extinct endemic group of Tertiary North American cetartiodactyls, whose internal systematic resolution and placement within Cetartiodactyla remain contested. Agriochoerid oreodonts represent the earliest and most morphologically primitive grade of oreodont evolution. Within this grade, there is a poorly-researched evolutionary division between species that lead to later agriochoerids and species that lead to Oreodontidae. As this division occurs sometime in the Uintan or Duchesnean, and there are agriochoerids from southern California from that time, it stands to reason that this evolutionary event could have been partially recorded in Southern California. However, only three publications ever have described or identified any specimens of agriochoerids from southern California, with most workers sorting California specimens into species from the better-studied western interior.

This research attempts to decipher how much of the Californian agriochoerid fossil record consists of species endemic to southern California. Early and middle Uintan deposits from San Diego County include an undescribed species that may also be known from the western interior. The existence of *Protoreodon walshi* of San Diego County and *Protoreodon pacificus* of Ventura County show that some endemism existed in the late Uintan – early Duchesnean. A late Duchesnean or earliest Chadronian locality from Death Valley has yielded the only described material for "*Protoreodon*" *transmontanus* and a single tooth possibly attributable to an undescribed species of *Agriochoerus*. Most of these species appear to be closer to the oreodontid evolutionary lineage, supporting a western interior origin for *Agriochoerus*.

140. PHYLOGENETIC POSITION AND BIOGEOGRAPHICAL IMPLICATIONS OF SOUTHERN CALIFORNIA TORTOISES

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Gopherus is a clade of tortoises that have been restricted to North America throughout their history. Gopher tortoises have been discovered throughout the Cenozoic of Southern California spanning over forty million years. A majority of these species remain undrescribed. The only described species is from the Miocene, *G. mohavetus*, and is known from Barstovian and Clarendonian sediments. The taxonomy and phylogenetic position of this species has been highly contested because of its lack of cranial and appendicular material.

Another gopher tortoise appearing to be closely related to *G. mohavetus* has been found in early Arikareean sediments of San Diego County. The discovery of this tortoise helps fill in a gap in the history of the western *Gopherus*, and adds a western record of the group during a time when the clade was only known to inhabit the Great Plains area.

An undescribed *Gopherus* from late Eocene sediments of San Diego County possibly represents the earliest diverging species of *Gopherus* known. This species is very similar in morphology to the earliest known testudinids known *Hadrianus majusculus*. A few characteristics of the shell and the cranial material distinguish the early diverging *Gopherus* from *H. majuscules*.

The description of these tortoises has added important details to understanding the evolution of the only group of tortoises still inhabiting North America. Collection of additional material and future descriptions of this material will help resolve the relationships of these species within *Gopherus*.

141. LAND MAMMALS FROM THE MIDDLE MIOCENE SHARKTOOTH HILL BONEBED, KERN COUNTY, CALIFORNIA

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The Sharktooth Hill Local Fauna is derived from the Sharktooth Hill Bonebed, which is in the upper part of the marine Round Mountain Silt in Kern County, southern San Joaquin Valley, California. The bonebed is well known for its marine vertebrate fossils, especially sharks and marine mammals, but has also produced a smaller number of significant land mammal fossils. These include the musteloid *Brachypsalis obliquidens*; a primitive true feline cat, *Pseudaelurus*, cf. *P. intrepidus*; the huge amphicyonid or "bear-dog", *Pliocyon medius*; the small borophagine dog *Paratomarctus temerarius*; a larger borophagine *Aelurodon* sp.; the three-toed browsing horses, *Parahippus* sp., and *Hypohippus* sp.; a distinctive grazing horse, "*Merychippus*" *brevidontus*; the tapir *Miotapirus* sp.; the rhinoceroses *Aphelops megalodus* and *Teleoceras medicornutum*; a generalized camel of the subfamily Miolabinae; a camel of the subfamily Aepycamelinae; the deer-like dromomercyid *Bouromeryx americanus*; the protoceratid *Prosynthetoceras* sp.; and a gomphothere *Miomastodon* sp. Together, this assemblage can be correlated to middle Barstovian age assemblages found in the Barstow Formation in the Mojave Desert, the Cache Peak Fauna in the Chanac Formation to the east in the Tehachapi Mountains, the North Coalinga sites on the west side of the San Joaquin Valley near the California Coast Range, and to other Barstovian assemblages elsewhere in North America. This agrees with previous assignments of a middle Miocene age to the Sharktooth Hill Bonebed that have been based on microfossils, mollusks, Sr-isotope dates, and magnetic stratigraphy (Chron C5Br, 15.5 Ma). The fossil land mammal assemblage in the Sharktooth Hill Local Fauna includes only medium- and large-size animals, probably an original bias reflective of a distant source area in the southern Sierra Nevada. The mammal assemblage is not biased among these size groups, however, being comprised predominantly of herding/grazing animals, with slightly less abundant browsing/solitary herbivores, and more rare carnivorans. The assemblage notably includes the one of the earliest North American records of a true feline cat, the last record (by 4 m.y.) of the tapir *Miotapirus*, some of the earliest North American records of the Barstovian-indicative gomphothere *Miomastodon*, and well-preserved examples of the dentally distinctive horse *"Merychippus" brevidontus*, the latter being also found in the North Coalinga Local Fauna and in the Cache Peak Fauna.

142. A NORTHERN OCCURRENCE OF THE COTTON RAT *SIGMODON MEDIUS* WITH *PLIOPHENACOMYS PRIMAEVUS* FROM LATE PLIOCENE AGE DEPOSITS OF LASSEN COUNTY, NORTHEASTERN CALIFORNIA

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Lake deposits in the Madeline Plains have produced *Sigmodon medius* and *Pliophenacomys primaevus* from a fish-bed considered to be late Pliocene (Blancan V) in age. This is the most northern documented occurrence of *Sigmodon* in the western United States and the first known record of *Pliophenacomys* in California. *Sigmodon* prefers warm climates with frost-free winter temperatures. The joint occurrence of *Pliophenacomys* with *Sigmodon* is reported in four Blancan V faunas in Kansas, Nebraska, South Dakota and Arizona. The faunas of the Plains states are between 2 and 3 Ma and occur near the same latitude as the Madeline Plains. These two rodents occur at 111 Ranch in Arizona at 2.5 Ma. Topographic barriers to the east appear prohibitive for a dispersal route for *Sigmodon* whereas it is common in Pliocene faunas of the southwest with a better dispersal route northeast of the Sierra Nevada. The Madeline Plains lake is significantly older than Pleistocene Lake Lahontan and contains a fish fauna with several endemic species intermediate between those represented in the early Pliocene Alturas Formation and Lake Lahontan. The absence of salmonids in the Madeline Plains lake implies no outlet to the Pacific Ocean. Sympatry of these two rodents presents an anomaly that requires either unique climatic conditions, different environmental tolerances for *Pliophenacomys* than its extant descendants, or tectonic conditions that provided an overlap of their geographic ranges. A large lake in this region 2.5 to 2 Ma may have ameliorated the winter temperature and produced frost-free conditions tolerable for *Sigmodon*.

143. A NEW IRVINGTONIAN LAND MAMMAL ASSEMBLAGE FROM THE SAUGUS FORMATION, MOORPARK, VENTURA COUNTY, CALIFORNIA

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The dominantly continental Saugus Formation recently yielded a newly recorded, fossil land mammal assemblage in the William Lyon Homes, Inc., Meridian Hills parcel at Moorpark, Ventura County, California. The Meridian Hills Local Fauna includes *Sylvilagus*?, *Thomomys*, *Perognathus*, *Dipodomys*, *Reithrodontomys*, *Neotoma*, *Pitymys meadensis*, *Mammuthus meridionalis*, *M. columbi*, *Equus occidentalis*?, and *Hemiauchenia macrocephala*. The *M. meridionalis* record, a skeleton ~70% complete, is one of the two most complete specimens known from North America. Its association with *M. columbi* is only one of three associations of these species reported from North America. *M. meridionalis* dispersed from Asia to North America about 1.8 million years ago, and went extinct in North America roughly 300,000 years ago. *P. meadensis* represents another such dispersal and defines the beginning of Irvingtonian II (earlier [but not earliest] part of Irvingtonian North American Land Mammal Age [NALMA]), which ranges from 850,000 to 400,000 years ago. The last record of this species is approximately 252,000 years in age. Associated magnetostratigraphic data indicate that the sediments comprising the fossil-bearing strata at the *P. meadensis*/*M. meridionalis* site were deposited during an geomagnetic interval of reversed polarity. In North America, the only reversed-polarity geomagnetic interval that overlaps the temporal ranges of *P. meadensis* and *M. meridionalis* is the Matuyama Magnetochron, which lasted from 2.58 million to 780,000 years ago. These data suggest that the fossil-bearing strata are 850,000 to 780,000 years (early Pleistocene) in age and assignable to the earlier (but not earliest) part of the Irvingtonian NALMA (Irvingtonian II).

144. REVISED TEMPORAL RESOLUTION OF THE LATE IRVINGTONIAN AGE FAIRMEAD LANDFILL FAUNA, MADERA COUNTY, CALIFORNIA

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The Fairmead Landfill fauna is a diverse assemblage of fossils vertebrates of late Irvingtonian age recovered from deposits of the Turlock Lake Formation. A recent examination of the stratigraphy at the landfill site with special emphasis on the bone concentration, coincident with a review of the geologic literature of the San Joaquin Valley indicates that the age resolution of this assemblage can be significantly

refined providing greater utility of the collection for paleontological interpretation. The fossils occur within the upper portion of, or directly above a brown clay bed located 40 feet below the ground surface. This clay bed has been identified as the Corcoran Clay, a very distinctive greenish-gray silty clay that is found at the surface and subsurface of the San Joaquin Valley covering an estimated 4,000 square miles. The Corcoran Clay is a member of the Turlock Lake Formation and is associated with a volcanic ash equivalent to the Lava Creek B ash with a radiometric date of 600,000 Ka. Directly overlying the Corcoran Clay Member is the Friant Ash Member of the Turlock Lake Formation that contains the Friant tuff radiometrically dated of 600,000+−0.15 Ka. The Friant ash bed has been identified in the deposits overlying the Corcoran Clay bed at the Fairmead Landfill indicating that both the Corcoran Clay and Friant Ash members are represented at the Fairmead Landfill. The Fairmead Landfill Fauna is of late Irvingtonian age and accumulated along the eastern margin of Lake Corcoran 600,000 Ka.

145. NEW RECORDS OF FOSSIL SHARKS AND BONY FISHES FROM THE LATE MIOCENE IMPERIAL GROUP OF THE ANZA BORREGO REGION, SAN DIEGO COUNTY, CALIFORNIA

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Although fossil marine invertebrates of the late Miocene Imperial Group of the Anza Borrego region of southern California are well documented, in contrast, little is known of the fossil fishes. Recent collections by paleontologists and volunteers of the San Diego Natural History Museum and Anza Borrego Desert State Park have yielded new records of sharks and bony fishes from Imperial Group. From the basal Latrania Formation, in addition to an early record of *Carcharocles megalodon* by Hanna (1926), teeth of *Odontaspis* sp., *Isurus* cf. *I. oxyrinchus*, *Myliobatis* sp., Balistidae, cf. *Semicossyphus* sp., and *Sphyraena* sp. were recovered. Based on the presence of fossil corals and sea urchins, the Latrinia Formation was probably deposited in clear marine waters of the ancestral Gulf of California on the western edge of the Salton Trough some 5 to 7 million years ago. In the overlying Mud Hills Member of the Deguynos Formation, recent collecting has turned up a tooth from a gulper shark (family Centrophoridae). Gulper sharks, related to the modern dogfish (genus *Squalus*), are mainly a group of deepwater marine bottom-dwelling species usually found in waters 1000–1500 m in depth. Today, they are not found in the northeast Pacific (this area). The Mud Hills Member clayey sediments chronicle the Colorado River entering the Salton Trough and building its delta some 5 million years ago. From the overlying Yuha Member of the Deguynos Formation, there are records of *Carcharodon* sp., *Odontaspis* sp., *Carcharhinus* sp., and *Myliobatis* sp. and an Istiophorid. Geologists interpret rocks of the Yuha Member to represent a delta front with oyster beds that was deposited some 4 million years ago.

146. A FOSSIL ZIPHIID WHALE (CETACEA: ODONTOCETI) FROM THE LATEST MIOCENE CAPISTRANO FORMATION IN SOUTHERN ORANGE COUNTY, CALIFORNIA

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Beaked whales of the odontocete cetacean family Ziphiidae are known from Early Miocene time to the present day, and from all oceans of the world. Several species are alive today, but they are generally uncommon, and some species are extremely rare. Fossil ziphiids are likewise rare. During a paleontologic mitigation program in San Clemente, Orange County, California, a fossil ziphiid was discovered in the latest Miocene (approx. 6 to 9 million years) Siltstone Member of the Capistrano Formation. The Siltstone Member was deposited in the ancient Capistrano Embayment in relatively deep and calm water. The ziphiid fossil includes the cranium, mandible, teeth, and ear bones. The cranial length was approximately 92 cm, and in life the animal would have been the size of a medium-size living beaked whale. The cranial vertex is not skewed asymmetrically to the left side, and the premaxillae are expanded

and elevated at their posterior ends and extend outward over the maxillae, thereby resembling both the living Baird's Beaked Whale, *Berardius bairdii*, of the North Pacific, and Shepherd's Beaked whale, *Tasmacetus shepherdi*, of the South Pacific. It further resembles *T. shepardi* in having rostral teeth, unlike all other living beaked whales, but unlike *T. shepardi* it may have had enlarged mandibular teeth. Its mandibular symphysis is longer than that of most living species of ziphiids. In most of its characters, the new fossil is relatively primitive, and it probably represents an undescribed species.

147. A MAMMOTH AND ASSOCIATED FAUNA FROM NEWPORT BACKBAY 25,000 YEARS BEFORE PRESENT

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Deep excavations at the corner of Jamboree and Michelson in Irvine have revealed at least three depositional layers with well preserved Pleistocene fossils. All represent overbank deposits outside of the river channel in an area that suffered numerous evaporation events. Radiocarbon dating indicates the deeper portions are about 30 thousand years old while the younger portions are about 25 thousand years old. Pollen indicates an arid, treeless expanse populated by members of the sunflower and goosefoot families. Orientation of the long bones indicates radical shifts in direction of river flow between depositional events. Selenite (gypsum) was present as a layer between the two lower deposits and caliche was present as a layer between the two upper layers. Overall, these results indicate flooding events that transported animal carcasses downriver and deposited them adjacent to the river channel. The sediments then dried out causing evaporates to form. Fossils recovered include rodents, turkey vulture, ground sloth, horse, bison and parts of two mammoths including a nearly complete skull with both tusks.

148. VARIATION AND SEXUAL SIZE DIMORPHISM IN PLEISTOCENE GROUND SLOTHS (XENARTHRA)

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According to the paleontological literature, ground sloths (especially megatheres) show unusually high variability compared to other mammals. We evaluated this hypothesis by measuring all the common limb elements of the mylodont *Paramylodon* (=*Glossotherium*) *harlani* from the late Pleistocene Rancho La Brea tar pits in Los Angeles, and the megathere *Nothrotheriops shastensis* from Rancho La Brea and also from late Pleistocene San Josecito Cave, Nuevo Leon, Mexico. We find no evidence of unusually large variability (as measured by coefficient of variation and other statistics) in any postcranial element of either of these taxa. We also evaluated change in size through time in the different aged pit samples from Rancho La Brea, and found no significant size changes in *P. harlani* from 40,000 to 10,000 years ago. This is consistent with the fact that some megatheres (such as *Eremotherium laurillardi*) show clear evidence of sexual size dimorphism, but *P. harlani* skulls exhibit shape, but not size, dimorphism. We conclude that sexual size dimorphism is not as widespread in sloths as once assumed.

149. PALEOENVIRONMENTAL INTERPRETATIONS OF PLEISTOCENE DEPOSITS AT THE PACIFIC CITY PROJECT SITE IN HUNTINGTON BEACH, SOUTHERN CALIFORNIA

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Samples of Pleistocene pond and stream deposits exposed in excavations for the Pacific City Project in Huntington Beach have produced both plant microfossils (pollen and spores) and macrofossils (seeds) which provide information on the depositional environment and both local and regional paleo-vegetation. Also present at this locality are aeolian (dune) sediments. Charcoal-bearing pond deposits near the base of the stratigraphic section have been radiocarbon dated at 40 kybp. The dominant floral elements present are herbs (Compositae/Asteraceae, Chenopodiaceae) and grasses (Poaceae), together making up more

than 60% of the palynoflora. Trees are dominated by oaks and pines, together making up only 3% of the palynoflora. Also represented are willow, alder, cottonwood, walnut, and sycamore, along with a few ferns, cattail, and an abundance of freshwater algal spores. Together with the sedimentary record at this site, this low diversity paleoflora suggests vernal pond vegetation in a coastal dune field near the mouth of the ancestral Santa Ana River. The local vegetation in this environment was dominated by seasonal herbs and perennial dune grasses. The regional vegetation included oak woodlands with occasional pines and junipers. The remaining elements in the paleoflora appear to represent riparian vegetation. The paleoclimate suggested by these samples is cooler and wetter than the modern climate of Southern California, and perhaps more like coastal central California.

150. NESTING SUCCESS OF COSTA'S HUMMINGBIRD IN ARTICHOKE THISTLE INVADED CALIFORNIA GRASSLANDS

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Artichoke thistle (*Cynara cardunculus* L., Asteraceae) is an invasive plant to coastal California that outcompetes native plants in disturbed areas, disrupting grassland habitat and potentially impacting wildlife populations. *C. cardunculus* is a food and nesting resource for hummingbirds. However, preliminary observations indicated that although hummingbird nests constructed on artichoke thistle produce hatchlings, these young rarely fledge due to plant structural failure resulting from the weight of the growing birds. We hypothesized that the overall interaction from the perspective of the hummingbird would be negative due to a failure to produce juveniles in thistle-invaded patches. The success of Costa's hummingbird nests built on *C. cardunculus* within an invaded grassland habitat in southern California was within normal ranges when compared to other researchers' values. This falsifies our hypothesis and suggests that the overall effect of *C. cardunculus* on hummingbird nest success is positive despite 76% nest failure. We also observed that nests built on live *C. cardunculus* were less successful than those on dead thistles. This may be because nests built on live thistle are more likely to collapse. In 2005 nest site selection revealed a slight preference for live thistles as substrate, and most nests failed. However, in 2006 birds preferentially nested on dead thistle, suggesting that learning is involved in selecting appropriate nest sites for Costa's hummingbird. *C. cardunculus* is a novel nesting and feeding resource that is absent in non-invaded grasslands, thus its presence benefits local hummingbird populations and may be a means of habitat expansion.

151. POPULATION STATUS AND TRENDS OF THE CALIFORNIA LEASTTERN, *STERNULA ANTILLARUM BROWNI*, AND THE WESTERN SNOWY PLOVER, *CHARADRIUS ALEXANDRINUS NIVOSUS*

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The least tern was listed as endangered with extinction in 1970 and the western snowy plover was listed as threatened in 1993. Both species rely on coastal beach strand or similar habitats for nesting. Dense human occupancy and activities along the coast pose major constraints to recovery of these two listed birds. Besides human disturbance of potential nesting areas, predators subsidized by human activities are abundant. The least tern population trend has been greatly increasing during the last several years. Creation and protection of man-made nesting areas and predator management have greatly benefited the least tern. The snowy plover population is currently much less numerous than the least tern and the trend has been erratic and, at best, slightly increasing. Both species sometimes share nesting areas and benefit from predator management and some nest site protection efforts. Major differences in nesting behavior and chick-rearing, make simultaneous management efforts for both species very difficult but not impossible. To date, creation of man-made nesting areas for snowy plover are few but have appeared to be successful when accompanied by predator management. The recent nesting occurrences of the rare gull-billed tern, *Gelochilodon nilotica vanrossemi*, at San Diego Bay has created another predator management quandary due to the predation on least tern and snowy plover chicks by gull-billed tern adults feeding their chicks.

152. DISTRIBUTION AND HABITAT ANALYSIS OF THE WESTERN BURROWING OWL IN AN URBANIZING ENVIRONMENT

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The western burrowing owl is a small, ground dwelling owl. It is found across western North America and into Central and South America. In general it is a habitat generalist, being found on grasslands, desert scrub, golf courses and a myriad of other sparsely vegetated habitats. It is, however, a specialist in regards to its nesting habitats as it is dependent on burrows excavated by ground burrowing animals such as ground squirrels, prairie dogs, badgers, tortoises and the like. It has been extirpated from portions of its historic range, and is declining in most other portions of its range. Its conservation has become a "hot" topic among California policy makers, conservationists and raptor biologists. The development of a habitat model for the express purpose of guiding conservation may be important. Using Western Riverside County as the study area, surveys were done over a four year period to locate owls. Using ArcGIS and a suite of habitat variables, a habitat suitability index was generated. This habitat model, or niche model, may provide some insight into the appropriate areas to concentrate on for conservation.

153. 2006 CACTUS WREN STUDY, NATURE RESERVE OF ORANGE COUNTY

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The 1993 Laguna Beach Fire burned ~75% of the coastal reserve of the Nature Reserve of Orange County (NROC). Annual Cactus Wrens sampling indicated a 58% decline, from 132 (±93) in 1999 to 55 (±40) in 2004, vs. a 26% estimated decline in the NROC's central reserve In 2006, during two rounds of surveys across the coastal reserve, I mapped and classified all cactus-containing habitats within 20 management areas and detected 65 wren territories. A site occupancy model gives a 2006 estimate of 71.4 (±6) territories in the coastal reserve (including non-reserve areas). Out of 2323 acres of cactus scrub mapped in 2006, 1336 acres (58%) appeared to be insufficiently developed for occupancy (mainly due to fire). Only 187 acres were occupied, whereas the model estimates occupancy of 1473 acres in 1992, an 87% decline. Out of eight management areas with at least 8 territories in 1992, only two areas in Irvine—Sand Canyon and Turtle Rock—showed no significant declines 1992–2006. Significant declines in two unburned management areas—Sycamore Hills and Aliso & Woods—may reflect differences in biological productivity (areas near grasslands being more stable), edge effects (but some edge areas have stable wren populations), and dispersal (dispersing wrens may preferentially settle in habitat near robust wren populations). Given the wren's small population in the coastal reserve, the slow recovery of burned cactus, and significant declines in some unburned areas, this population warrants further study and development of a management program that aims toward short-term population stabilization.

154. *CHARADRIUS ALEXANDRINUS* POPULATION SURVEYS AT OWENS DRY LAKE, INYO COUNTY CALIFORNIA PRE- AND POST SHALLOW FLOOD DUST CONTROL IMPLEMENTATION

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In a historic Memorandum of Agreement between the U.S EPA and the Los Angeles Department of Water and Power (LADWP), LADWP agreed to control dust emissions on the Owens dry lake bed to meet PM^{10} air quality standards. Ten years and hundreds of million dollars later the once dry lakebed has over 10 square miles of shallow flooded surface that not only suppresses dust, but supports abundant brine fly populations (*Ephydra hians*) and a burgeoning shorebird population. The Western snowy plover (*charadrius alexandrinus nivosus*) has historically nested at Owens Dry Lake between March and August each year and the baseline adult population was estimated at 272. With the construction of water-based dust control measures this population has steadily increased reaching a high of 658 adults in 2004 and 602 adults in 2006. Nesting success has increased, as has the number of clutches each season per adult female. Pre-project the plover were dependent on 3 or 4 natural seeps that outflow onto the dry lake bed and dry

as the summer progresses limiting the useable nesting area to roughly ½ mile around each seep and focusing predation in these areas. Shallow flood dust control sprinklers provide seep like conditions over 10 square miles of the dry lake bed on a consistent basis through most of the breading season resulting in a reliable source of food and water within and adjacent to the dust control areas that greatly expands potential nesting area and reduces predation.

155. THE SANTA ANA RIVER FROM CREST TO CREST – A PHOTO EXPLORATION

Patrick Michell.

Abstract not received at time of publication.

156. LEAST BELL'S VIREOS OF THE SANTA ANA RIVER – RECOVERY IN PROGRESS

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The Least Bell's Vireo, *Vireo belli pusillus*, is an endangered bird of riparian habitats in California and Mexico. Its decline is due to habitat loss and nest parasitism by Brown-headed Cowbirds, *Molothrus ater*. A low count of 19 pairs was documented in Prado Basin in 1986 by U.S. Fish & Wildlife biologists. A management program consisting of habitat restoration and cowbird trapping was initiated at Prado Basin in a cooperative effort among the Orange County Water District, the Army Corps of Engineers, and the U.S. Fish & Wildlife Service. The Santa Ana Watershed Association (SAWA), a non-profit organization dedicated to the restoration and enhancement of natural resources along the Santa Ana River, joined the effort in 1997. SAWA has enacted major habitat restoration for the vireo with the removal of approximately 3,000 acres of giant reed, *Arundo donax*, and associated invasive species from the watershed since 1997. Over 70,000 Brown-headed Cowbirds have been removed from the Prado Basin since 1986 and over 10,000 cowbirds have been removed outside the Prado Basin by SAWA since 2000. The Least Bell's Vireo population in the watershed has increased from 19 territories in 1986 to 991 in 2005. Parasitism rates, which in the early 1980s were as high as 100%, significantly declined in the Prado Basin after the initiation of cowbird trapping (Chi-square 2×2 contingency table; statistic = 20.3 [Yates correction factor applied]; $p < 0.00001$). Annual data collected on the vireos' reproductive success, parasitism rates, depredation rates and nest site characteristics are briefly presented.

157. RESTORATION OF THE RIPARIAN FORESTS OF THE SANTA ANA RIVER. THE SANTA ANA RIVER WATERSHED PROGRAM, 1997–2007

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Encompassing 3,200 square miles, the Santa Ana River Watershed is the largest drainage in coastal southern California. The river originates in the San Bernardino and San Gabriel Mountains and flows over 100 miles through San Bernardino, Riverside, Los Angeles and Orange Counties to the Pacific Ocean. The Santa Ana River Watershed Program was formed in 1997 to restore the natural functions of the river through control of destructive, invasive species, restoration of habitat, and wildlife management emphasizing rare and endangered species. The Watershed Program is a collaborative attempt of the Santa Ana Watershed Association to focus public and private funding on prioritized natural resources issues. The component agencies include four Resource Conservation Districts on the river, Orange County Water District, and the U.S. Army Corps of Engineers; partners include the U.S. Fish and Wildlife Service, California Department of Fish and Game, Regional Water Quality Control Board, Santa Ana Watershed Project Authority, Riverside County Parks and Open Space District, the counties, cities, and many others. Approximately 3,000 acres of giant reed, *Arundo donax* have been removed at a cost of about $14,000,000 and native riparian habitat has expanded into at least 50% of the reclaimed floodplain.

158. HERPETOLOGICAL SURVEYS OF THE SANTA ANA WATERSHED

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The Santa Ana Watershed Association (SAWA), a non-profit organization dedicated to the restoration and enhancement of natural resources along the Santa Ana River, is conducting herpetological surveys in support of restoration activities throughout the Santa Ana Watershed. Surveys are conducted following the pit-fall trapping design by Stokes, et al 2001. Since 2003, 5 sites have been inventoried including Santiago Canyon, Temescal Canyon, San Timoteo Canyon (2 locations), and the former marine base at El Toro, for a period of one year each. A total of 20 reptile and 5 amphibian species have been captured for a total 25 herpetofauna species. Common species found at all locations include western toad (*Bufo boreas*), side-blotched lizard (*Uta stansburiana*), western fence lizard (*Sceloporus occidentalis*) and southern alligator lizard (*Elgaria multicarinatus*). California Species of Special Concern found at one or more locations include western spadefoot toad (*Spea hammondii*), orange-throated whiptail (*Aspidoscelis hyperythra*), coast horned lizard (*Phrynosoma coronatum*), coast patch-nosed snake (*Salvadora hexalepis*) and red diamond rattlesnake (*Crotalus ruber*). Incidental captures of up to 7 small mammal species were noted. Capture and incidental sighting data, as well as vegetation characteristics and soil types are presented for each sampling site.

159. HISTORICAL CHANGES IN THE FRESHWATER FISH FAUNA OF THE SANTA ANA RIVER

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The Santa Ana River watershed covers an area of about 2,650 square miles. Historically the watershed included approximately 3,900 miles of streams, both perennial and intermittent, that could support aquatic resources and only one natural freshwater lake of significant size, Lake Elsinore. Over the past 200 years, much of the landscape and resources of the Santa Ana River watershed have been changed by settlement and development. About 32 percent of the land use is residential, commercial, or industrial. Agricultural land, once accounting for virtually all of the land use in the watershed in the days of the ranchos, now accounts for about 10 percent. Instead of a scattered population of indigenous peoples, the watershed now supports more than 5 million people. It is not surprising that the fish fauna of the Santa Ana River watershed has changed dramatically since the first significant diversions of water were made by the Spanish in 1818. Historically, the Santa Ana River contained a limited fish fauna of only eight species of native freshwater fish. Currently, four of the eight fish species are believed to be extirpated from the watershed. The four native non-estuarine fish that remain are the arroyo chub, Santa Ana speckled dace, Santa Ana sucker, and the threespine stickleback. All of these remaining fishes have limited distributions and may be subject to extirpation. The Santa Ana sucker is listed by the federal government as a "threatened" species pursuant to the ESA. In contrast at least 33 fishes have been introduced into the Santa Ana River watershed, are currently present, and new species can be expected to be found at any time due to inter-basin water transfers, dispersal of species introduced by ships emptying their ballast water, bait bucket introductions, and hobbyists disposing of unwanted fishes. Government agencies introduced most of these to serve as a food resource, for sport fishing, as forage for sport fishes, or for mosquito and aquatic plant control.

160. BIOLOGIC, HISTORIC AND SOCIAL CONSIDERATIONS FOR INTRODUCTIONS OF SANTA ANA SUCKER (*CATOSTOMUS SANTAANAE*) AND SANTA ANA SPECKLED DACE (*RHINICHTHYS OSCULUS* SSP.) INTO THE UPPER SANTA ANA RIVER

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The upper Santa Ana River, between the Seven Oaks Dam and it's confluence with Bear Creek, has recently become an area of interest for multiple parties concerned with the survival and recovery of Santa Ana sucker (sucker) and Santa Ana speckled dace (dace). Although it is unclear if either of these species

ever inhabited this section of the river, recent developments in water use and diversion authorizations have "recreated" a perennial stretch of the river that had previously been subject to intermittent flows. Assessment of current fish and macroinvertebrate assemblages indicate that this reach of the river does currently provide suitable habitat for sucker and dace. Both of these species are experiencing severe habitat and distribution declines and multiple agencies and organizations are taking an interest in finding suitable habitats where they can be introduced as a part of a conservation or recovery effort. In this presentation we provide a review of some of the history of this stretch of the river along with descriptions of some social, political and biological issues that have shaped the past and present condition of the river. Discussion of a potential future condition as a recovery/refuge habitat for sucker and dace will be presented in the context of known conflicts with nonnative species, ongoing recreational and consumptive uses, and proposed water developments

161. FLORA OF THE SANTA ANA RIVER

Oscar F. Clarke and Greg Ballmer.

The Santa Ana River is central to the regional ecology of the greater Los Angeles-Inland Empire area. Its main watercourse and tributaries drain about 2400 sq. miles, linking the Santa Ana, San Bernardino, San Gabriel, and San Jacinto Ranges, plus Chino Hills, with the sea shore and provide the most extensive network of natural wildlife habit linkages in Cis-montane Southern California. Diverse habitats within the watershed also support a proportionately great diversity of plant species; the lowland plants (below 3000 ft elevation) are the primary focus of the recently published **Flora of the Santa Ana River and Environs, with References to World Botany**, by Oscar. Clarke, Danielle Svehla, Greg Ballmer, and Arlee Montalvo. The text deals with 1365 taxa, of which 496 are exotic. About 900 of the more frequently encountered and/or biologically most significant species are illustrated in some detail. The text also includes diverse information on plant origins, ecology, anthropogenic uses, and relationships to other plants. This presentation will focus on the production history of the book, including the techniques and the philosophy behind its unique construction

162. DEMYSTIFYING A RARE AND SECRETIVE SPECIES OF THE SANTA ANA RIVER, THE SOUTH COAST GARTERSNAKE (*THAMNOPHIS SIRTALIS* SSP.)

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Recently the boundaries separating the three currently recognized subspecies of the common gartersnake (*Thamnophis sirtalis infernalis*, *T. s. fitchi*, and *T. s. tetrataenia*) within California have been reinterpreted (Rossman et al. 1996 vs. Stebbins 1985, 2003). Additionally, the distribution patterns of these subspecific units, historically defined by fairly uniform color patterns, are not supported by molecular evidence (Janzen et al. 2002). These developments are not surprising considering the genus *Thamnophis* has a notoriously confusing taxonomic history. First reported in 1994, Jennings & Hayes suggested that the population of *T. s. infernalis* (termed, South Coast gartersnake), occurring south of the Transverse Ranges and west of the Peninsular Ranges, was possibly a unique and undescribed form. The South Coast gartersnake (*T. sirtalis* ssp.) has highly localized populations in Ventura, Los Angeles, San Bernardino, Riverside, Orange, and San Diego, Counties. However, based on our findings, this species is possibly extinct from Los Angeles and San Bernardino, Counties. Currently the South Coast gartersnake is a CDFG Species of Special Concern.

In an attempt to better understand the life history, ecology, distribution, and taxonomic status of the South Coast gartersnake (*T. sirtalis* ssp.) we have begun conducting several studies to resolve these uncertainties. In this presentation, our first in a series, we provide an updated distribution map that includes many previously unreported records, describe essential habitat features, and discuss landscape changes that have enhanced populations at some locations and likely eliminated populations elsewhere. The greatest number of records for the South Coast gartersnake are from the Santa Ana River and the greatest concentration of the records is within the Prado Basin. These records present a unique opportunity for studying this rare and secretive species on a finer scale not previously possible.

163. CHANGES IN HABITAT AFFECT THE POPULATION DYNAMICS OF THE FEDERALLY THREATENED SANTA ANA SUCKER, *CATOSTOMUS SANTAANAE*, IN THE SANTA ANA RIVER

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To elucidate forces that influence *Catostomus santaanae* population dynamics in the Santa Ana River, the Santa Ana Sucker Conservation Team, which is comprised of scientists, regulators and stakeholders, conducted several observational and experimental studies. First, a microhabitat selectivity study revealed that adult and juvenile fish tend to select habitats with cobble/gravel substrate and avoid sand-dominated environments. Next, annual censuses and habitat assessments demonstrated that abundance decreased in two downstream sites and increased at one upstream site between 2003 and 2006. The decreases were likely caused by a temporal shift in substrate composition from cobble/gravel to sand. Next, a 2006 survey of substrate along a 30-km stretch of the river revealed that cobble/gravel is mostly confined to the upstream 8 km whereas downstream locations are mostly sand. Comparison of the 2006 habitat survey with data from 2000 indicated that cobble/gravel declined significantly among years. The Team currently is conducting experiments seeking to augment cobble/gravel habitat through the placement of gabion structures into the river. Gabions have the potential to expose cobble/gravel that may be covered by sand by increasing scour along gabion edges. Preliminary results indicate that gabion addition successfully uncovered buried cobble/gravel habitat. Overall results stress the importance of cobble/gravel habitat to *C. santaanae* persistence and suggest that large-scale sedimentation may be degrading *C. santaanae* habitat. In light of this finding, the Team is striving to develop a management strategy that simultaneously alleviates this threat while allowing for a myriad of ongoing, vital anthropogenic activities in the Santa Ana River.

164. AQUATIC INSECTS OF THE SANTA ANA RIVER: COMMUNITY STRUCTURE AND BIOASSESSMENT ON ALTITUDINAL GRADIENT

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The aquatic insects of the Santa Ana River were sampled biennially between 2002 and 2006 in April at 2–3 locations between 1680 m ASL and 238 m ASL as part of a bioassessment training exercise. Taxon richness declined directly with elevation. The number of aquatic insect genera collected in samples at the high elevation site was 3–5 times that collected in samples at the low elevation site. The mean biotic index based on genus- to family-level identification was approximately 5–6 at Rubidoux, 4.6 at Highland and 3.5–2.5 at Seven Oaks indicative of fair to fairly poor water quality at the low elevation site and excellent water quality near the headwaters. Water column chlorophyll biomass, bacteria abundance, pH, specific conductance and discharge at Rubidoux were comparatively higher than at Seven Oaks. The relative abundance of aquatic insect functional feeding groups conformed well to the river continuum concept that predicts changes in faunal composition with stream order, energy inputs and ecosystem function. Collectors were only about 53% of specimens in samples taken near Seven Oaks. Filterers accounted for 14%, grazers accounted for 18%, and predators and shredders comprised the remaining 15% of specimens in samples from the high altitude site. Collectors were approximately 90% of the insects collected from the comparatively sandy substrates at Rubidoux. The most abundant benthic insects in the lower Santa Ana River were moderately pollution-tolerant generalist feeders and rapid colonizers such as Simuliidae (black flies), Chironomidae (midges), and Baetidae (mayflies) that can tolerate the interannual differences in scouring.

165. *PSEUDO-NITZSCHIA* BLOOM DYNAMICS IN COASTAL WATERS NEAR LOS ANGELES AND CONFIRMED CASES OF DOMOIC ACID POISONING IN MARINE MAMMALS

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The presence of toxic algal species that belong to the genus *Pseudo-nitzschia* in coastal waters along the Los Angeles and Orange County shorelines has been documented repeatedly in recent years. Commensurate with toxic blooms of *Pseudo-nitzschia*, hundreds of marine mammals (pinnipeds and cetaceans) have been received in Mammal Care Centers in Southern California. The animals fall sick and frequently die after consuming domoic acid-contaminated prey such as planktivorous fish which ingest the algae. The time lag between increases of domoic acid (DA) concentrations in the water, the contamination of potential prey (eg, sardines and anchovies) and consecutively the contamination of top predators such as Californian sea lions is not well documented. Transfer efficiencies and residence times of the toxin within the food web are essentially unknown. Comprehensive monitoring of bloom dynamics (eg, cell abundances and DA concentrations) by the University of Southern California, in conjunction with DA-testing of stranded animals made possible by the Mammal Care Centers, is beginning to provide insight into the relationship between toxic blooms and animal poisonings within the LA coastal region. One of the goals of this work is the use of information on the severity and duration of toxic blooms to aid mammal rescue and rehabilitation efforts.

166. DOMOIC ACID POISONING OF CALIFORNIA SEA LIONS IN SOUTHERN CALIFORNIA WATERS: CLINICAL AND PATHOLOGICAL FINDINGS

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For the past 8–10 years, poisoning by the ...toxin Domoic Acid (DA) has been recognized as a very significant category of mortality for California Sea Lions (*Zalophus californianus*) in southern California waters. This short review will illustrate the clinical and pathological findings noted in DA intoxication in these animals. Clinical and pathological findings are attributed to: 1) anorexia with resultant cachexia or dehydration, malnutrition and subsequent decline in body condition and 2) neurologic dysfunctions from specific biochemical pathologies of the central and peripheral nervous systems, which are the result of direct competitive action with neuronal neurotransmitters at their receptors. Clinical signs include varying degrees of somulence, paresis, paralysis, unusual locomotion, blindness and hearing dysfunctions, which are frequently upstaged by varying types and stages of seizure activity, often as *status epilepticus* or continous epileptiform convulsions. Pathologic microscopic lesions are generally noted in the central and peripheral nervous systems as well as the eye and heart. In the central nervous system, the *Hippocampus* is targeted with extensive degeneration and loss of large neurons within CA areas as well as the *Dentate Gyrus*.

167. LEVELS OF PCBS AND DDT IN PINNIPEDS OF THE SOUTHERN CALIFORNIA BIGHT

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Coastal regions adjacent to highly industrialized areas, such as the Southern California Bight (SCB), often have sediment repositories of chlorinated pesticides, such as dichlorodiphenyltrichloroethane (DDT), and polychlorinated biphenyls (PCBs) that can chronically expose organisms to these pollutants long after the use of these materials has ceased. One of the most susceptible groups of marine organisms is the pinnipeds because of their high trophic standing and high lipid content. PCBs and chlorinated pesticides were analyzed in the blubber of 146 pinnipeds (92 California sea lions *Zalophus californianus*; 43 northern elephant seals *Mirounga angustirostris*; and 11 harbor seals *Phoca vitulina*) acquired from stranded animals that died at local marine mammal centers in the southern California region between 1994–2006. DDTs were the most predominant contaminants, followed by PCBs, chlordanes, and BHCs. Northern elephant seals had significantly lower concentrations of tPCB and tDDT than California sea lions and harbor seals. Adult female California sea lions typically had significantly lower concentrations of tDDTs and tPCBs than the pup, yearling, and adult male age and gender classes. There was a significant decline in both tDDTs and tPCBs over time occurring in California sea lions, but not for northern

elephant seals. Current concentrations of tDDTs and tPCBs in California sea lions and harbor seals are among the highest values reported worldwide for marine mammals in recent years and exceed those reported to cause adverse health effects in harbor seals.

168. A PRELIMINARY EXAMINATION OF MORTALITY PATTERNS IN STRANDED SAN DIEGO COUNTY CETACEANS, 1978–2006

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Between the years 1978 and 2006, 375 cetaceans stranded (dead and alive) along San Diego Co. coastline, averaging 13 (range: 5–23) per year. Post-mortem examinations were conducted on a total of 81 cetaceans, representing 3 species of mysticetes and 9 species of odontocetes. Overall, mortalities were attributed to the following categories: trauma (23.5%), undetermined (21.0%), other (13.6%), encephalopathy (8.6%), pneumonia (7.4%), sepsis (6.2%), stillbirth (4.9%), domoic acid toxicosis (4.9%), neoplasia (2.5%), coccidiomycosis (2.5%), hepatitis (2.5%), and pulmonary edema (2.5%). Single cases of the following conditions contributed to the "other" category: abdominal wall perforation, brucellosis, congestive heart failure, emaciation, erysipelas, lymphadenitis and peritonitis, nasal sac trematode aberrant migration, neonatal status, nephritis, ankylosing spondylitis, and vaginal necrosis. Peaks in bottlenose dolphin (*Tursiops truncatus*), short-beaked common dolphin (*Delphinus delphis*), and long-beaked common dolphin (*Delphinus capensis*) strandings occurred during the years 1980, 1989/1995/2003–2005, and 2004/2006, respectively. Although 66.7% of *T. truncatus* strandings were necropsied in 1980, no clear trend in mortality diagnoses was apparent; this suggests that observed maladies may have been secondary to infectious or biotoxic agents unknown to researchers at that time. *D. delphis* strandings from 2003 and 2005 were partially attributed to domoic acid toxicosis and encephalopathy while the peak in *D. capensis* in 2004 was largely due to trauma, primarily from fishery entanglement. Stillbirths and domoic acid toxicosis were only observed in bottlenose dolphins during the early 1980s and common dolphins (*Delphinus* sp.) after 2002, respectively. The limitations of diagnostic evaluations and rapidly developing new methods necessitate thorough post-mortem examinations and proper banking of samples for future evaluations.

169. *STAPHYLOCOCCUS AUREUS* NEPHRITIS IN A CALIFORNIA SEA LION (*ZALOPHUS CALIFORNIANUS*)

V. Favel. Pacific Marine Mammal Center, 20612 Laguna Canyon Road, Laguna Beach, CA 92651

This presentation will be an illustrative documentation of a case *Staphylococcus aureus* severe, diffuse, bilateral nephritis in the California Sea Lion (*Zalophus californianus*). Gross, cytological and histological lesions will be shown in detail and the relevance of semi-isolated Renicular lesions will be discussed in terms of sea lion kidney anatomy. In conclusion, a discussion of the significance of *Staphylococcus aureus* as a pathogen in the California Sea Lion will be undertaken.

170. CONSIDERATIONS IN MARINE MAMMAL BRUCELLA INFECTIONS

J.A. St. Ledger. SeaWorld, San Diego, CA 92109

Infections with the marine mammal strains of *Brucella sp.* are identified with increasing frequency. Improved diagnostics and an expanded understanding of the behavior of the pathogens will likely result in increasing identification of the infection. Recent studies on European isolates identify 3 distinct species of *Brucella sp.* in marine mammals. The condition in cetaceans is associated with a non-suppurative encephalitis, steatitis, endometritis, placentitis, and vaginitis. Clinical conditions can include abortion, still birth, and obstructive hydrocephalus. Infections in pinnipeds can be non-clinical. Based on comparative pathology, other potential conditions associated with these infections include arthritis, diskospondylitis, and orchitis. Diagnosis of these infections remains an art. Bacterial culture of the two cetacean *Brucella sp.* can be performed on blood agar in aerobic conditions at 37 deg. Pinniped organisms require CO_2 for culture. All marine mammal isolates are slow growers and a manimum 21 days of incubation are

recommended. Overgrowth of secondary bacteria is a common culture complication. Immunohistochemistry on suspect lesions may prove unrewarding. Polymerase chain reaction (PCR) is an effective method for identifying bacteria when culture is difficult or impossible. Because bacteria can be isolated without clinical impact or pathologic changes, positive result must be evaluated in light of clinical history and clinical and anatomic pathology. Increased screening for this infection, identification of history and lesions, and further classification of isolates is necessary to better understand the impact of *Brucella sp.* infections in marine mammals. Zoonotic disease precautions should be considered with any marine mammal *Brucella sp.*

171. TOPICAL TREATMENT OF A SHARK BITE IN A CALIFORNIA SEA LION (*ZALOPHUS CALIFORNIANUS*) WITH UNPASTEURIZED HONEY

L. Palmer. The Marine Mammal Care Center Fort MacArthur, San Pedro, CA 90731

In this case report commercially available, unpasteurized honey was utilized as a wond dressing for a yearling, female, California sea lion (*Zalophus californianus*) that had sustained injuries consistent with a shark bite. The animal was admitted with extensive contaminated wounds. In this case, unpasteurized honey effectively debrided necrotic tissue eliminating the need form standard surgical debridement. Bandages were changed every 48 hours and tissue repair and healing were rapid facilitating early return to a pool and eventually to release. A few of the reported therapeutic properties of honey include antibacterial, anti-inflammatory, and tissue debriding properties that are a result of low pH, production of low levels of hydrogen peroxide, high osmolality and stimulation of leukocyte activity. No known adverse effects were noted from the use of honey as a wound dressing in this case.

172. TIDAL DYNAMICS OF FECAL INDICATOR BACTERIA (FIB) IN THE BALLONA WETLANDS, LOS ANGELES COUNTY, CALIFORNIA

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Densities of fecal indicator bacteria (FIB), represented by total coliforms, *E. coli*, and enterococci, were measured in a tidal channel of the Ballona Wetlands (Los Angeles County) to determine fluxes over varying tidal cycles, ultimately addressing the question whether or not the wetlands act as a sink or source of these bacteria. Densities of FIB along with environmental parameters were measured at a single site every 1.5-hrs over a 12-hr period. Four events representing spring to neap tidal conditions were sampled on June 6, 13 and 19, 2006, and on March 2, 2007. Parameters measured every 1.5-hrs included current flows, replicate surface water samples (n=3) for FIB and turbidity (NTU). Measurements of depth (ft), oxygen (mg/L), temperature (C°), and pH were taken every 15-min using YSI 6600 continuous recording sonde. Tidal flows ranged from 1.13 m^3/sec during flood and ebb flows to nearly still conditions. Bacterial concentrations (MPN/100 ml) of all FIB groups tended to be greatest during flood flows, especially during morning hours, diminishing throughout the day. Peak bacterial densities averaged 24,192 MPN/100 ml for total coliforms, 208 for *E. coli*, and 3,889 for enterococci. Bacterial flow rates (MPN/sec) tracked water flow rates (m^3/sec) with the greatest bacterial flows of 10^8 MPN/sec. Overall, FIB densities tended to diminish throughout the day even during flood conditions, suggesting that UV light might be a reducing factor. This hypothesis will be tested during the summer of 2007 when FIB sampling will be performed over a 24-hr period coupled with measurements of light intensity.

173. PRELIMINARY ETHNOBOTANICAL INVESTIGATION ON CURRENT USE OF *HYDROCOTYLE RANUNCULOIDES L.F.* IN IXTLAHUCA AND SAN MATEO, TEXCALYACAC, MEXICO

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Hydrocotyle ranunculoides L.f. (Apiaceae,), known as "quelites san reje" in Ixtlahuaca and "berro redondo" in San Mateo, Texcalyacac, Mexico, are small aquatic plants found in the wetlands that are prominent in the Valley of Mexico of Mexico State. Ixtlahuaca and San Mateo, Texcalyacac are both located in the Valley of Mexico and are the ancestral home to the indigenous Otomi, Matlatzinca, Mazahuaz, and the Mexica groups. Since the 16th century *H. ranunculoides*, known by the Mexica as "amamalacotl" meaning swirl of wind in Nahuatl, was used as a condiment and to treat minor illnesses. Currently documentation in Mexico on the current knowledge and use of this plant is limited. This study investigates the current use and ethnobotanical knowledge of *H. ranunculoides* in the towns of Ixtlahuaca and San Mateo, Texcalyacac Mexico. This floating plant is harvested form the local wetlands, rinsed, cleaned, and sold fresh. Only specific locations sell *H. ranunculoides* and a decrease in its use has been reported by local people, possibly due their understanding of unsanitary water systems where this plant is harvested. The overexploitation of groundwater resources from this valley is also a threat to the loss of the wetlands and potentially the valuable cultural knowledge of harvesting emergent aquatic plants including *H. ranunculoides*.

174. THE USE OF BEDSIDE ULTRASOUND TO DETECT FREE FLUID IN TRAUMA PATIENTS

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The Focused Assessment Sonogram in Trauma (FAST) in the evaluation of blunt abdominal trauma is generally accepted as the screening modality of choice in adult populations to evaluate for free fluid (FF). However, there are few studies demonstrating its accuracy in the pediatric population, which is what was assessed in this study. This prospective observational study included a consecutive sample of patients aged 0–17 years, suffering blunt abdominal trauma requiring trauma activation that received either CT scans or underwent laparotomy, at a tertiary care Level I Trauma Center University Hospital. After obtaining assent/consent, the senior emergency medicine resident performed and interpreted the FAST at bedside. Using CT scans as the criterion reference, the FAST results were compared to those of CT using descriptive statistics setting the Confidence Interval at 95%. Of the 118 total participants, none were excluded after initial inclusion. Nine percent had a positive FAST showing FF in the abdominal/pelvic cavity. Of those, 100% had a subsequent positive CT scan. Five subjects went to the operating room within 24 hours of evaluation. Of those, three had a positive FAST, demonstrating the sensitivity of FAST in detecting clinically-significant levels of FF is 60%. Overall, the sensitivity of the FAST to illustrate any amount of FF in the abdominal/pelvic cavity is 40%, with a specificity of 99%, positive predictive value of 89%, and likelihood ratio of 39.2. The results indicate pediatric FAST is very specific, but less sensitive than that reported in the adult literature for all degrees of FF.

175. ARMORED MIXED-SOFT SEDIMENTS -A DISTINCTIVELY DIFFERENT SEDIMENT PARADIGM?

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Based on our studies from 1989 through 1996 evaluating effects of treatment of beaches oiled by the *Exxon Valdez* oil spill in Prince William Sound (PWS), we hypothesized that bivalve assemblages and sediments on treated beaches were severely injured by high-pressure washing. In 2002, we conducted a follow-up study to determine if these effects persisted and were widespread in PWS and to gain insight into clam recovery rates. During this study, we found that sedimentary components and the biota in the armored mixed-soft sediments in PWS do not respond in accordance with the conventional paradigms described for homogeneous sediments. Relationships between median grain size, fines, organics, and biodiversity in PWS sediments diverge substantially from those commonly used to describe traditionally recognized homogeneous sediments. Although armored sediments apparently are widely distributed, paradigms describing the relationships among grain size, fines, organics, and biodiversity in armored sediments do not appear to have been reported previously. Moreover, the importance of armoring to these

sedimentary and infaunal relationships has not been recognized. In this presentation, we will demonstrate the differences in the paradigms between these two sediment regimes and explain the process by which armoring develops.

176. DELAYED RECOVERY IN INTERTIDAL CLAM ASSEMBLAGES IN PRINCE WILLIAM SOUND FOLLOWING THE *EXXON VALDEZ* OIL SPILL CLEANUP

D.C. Lees[1] and W.B. Driskell[2]. [1]Littoral Ecological & Environmental Services, 1075 Urania Ave., Leucadia, CA 92024; [2]6536 20th Ave. NE, Seattle, WA 98115

Our studies of the effects of shoreline treatment on beaches oiled during the *Exxon Valdez* oil spill in Prince William Sound (PWS) from 1989 through 1996 suggested that bivalve assemblages on the beaches treated with high-pressure washing were severely injured in terms of abundance, species composition, and function. In 2002, we conducted a follow-up study to determine the generality and persistence of this injury in PWS. We found that the initial conclusions were accurate, i.e., a considerable proportion of mixed-soft beaches in treated areas of PWS remained extremely disturbed and were functionally impaired in terms of their ability to support foraging by humans and damaged nearshore vertebrate predators such as sea otters. Large, long-lived hard-shell clams, lprimarily littleneck and butter clams (*Protothaca staminea* and *Saxidomus gigantea*) remained 66% less abundant at Treated sites than at Reference sites. We also found that standard sediment properties did not appear implicated in lagging clam recovery. But, based on several lines of evidence, we deduced that a major cause for the delay was the disruption of surface armoring (a stratified organization of mixed-soft sediments common in southcentral Alaska) caused by beach washing. Based on the apparent recovery trajectory, we predict that recovery to pre-spill status will take several more decades

177. BALANCING RANIDS AND RECREATION: FOREST SERVICE EFFORTS TO PROTECT MOUNTAIN YELLOW-LEGGED FROGS AND QUALITY RECREATION OPPORTUNITIES

Gar Abbas, Anne Poopatanapong, and Marc Stamer. USDA Forest Service, San Bernardino National Forest, San Bernardino, CA 92408

The mountain yellow-legged frog (*Rana muscosa*, MYLF) was historically one of the most common frogs in Southern California being found in virtually every perennial stream in the San Jacinto, San Bernardino and San Gabriel Mountains. They have dramatically declined statewide and the Southern California population segment was listed as endangered in 2002. The National Forest system houses most of the last known MYLF populations in Southern California and the Forest Service is actively pursuing measures to protect remaining populations and promote recovery. The San Jacinto Mountains, on the San Bernardino National Forest, are home to one of the largest remaining populations of MYLF and some of the best available habitat for potential recovery. The San Jacinto Mountains are also located within a two hour drive of Los Angeles, and just outside Palm Springs, making these mountains a popular area for outdoor recreational activities. In 2001 the Forest Service started monitoring recreational use in the vicinity of MYLF habitats on the San Jacinto Ranger District to document any conflicts. This data and examples of adaptive management actions taken are presented along with descriptions of other efforts the Forest Service is locally involved in to protect and restore MYLF populations and habitats.

178. CHRONOTROPIC AND INOTROPIC EFFECTS OF HAWTHORN (*CRATAEGUS OXYCANTHA*) EXTRACTS IN CARDIOMYOCYTE-BASE ASSAY

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Hawthorn is a fruit-bearing shrub with a long history as a medicinal substance. Hawthorn is used as an alternative therapy for a variety of cardiovascular conditions, including arrythmias and heart failure. Hawthorn extracts exhibit negative chronotropic and positive inotropic cardiac properties. The first aim of this study was to show the chronotropic property of hawthorn extracts on atrial and ventricular tissues in

a cultured neonatal murine cardiomyocyte assay. We tested several different preparations of hawthorn extract (commercial Heartcare® tablet extract, crude ethanolic extract of deried leaves and stems, or size exclusion column fractions of partially purified leaf and stem extract) and found that all decreased the rate of atrial cardiomyocyte contraction. However, differential effects were noted on atrial versus ventricular cardiomyocytes in culture. Ethanolic extract of dried leaves and stems had a multiple cardioactive components in the complex extract. We are attempting to isolate the negative chronotropic component of hawthorn extracts. The second aim was to discover a possible mechanism underlying the positive inotropic property of hawthorn extract in the cardiomyocytes. For this purpose, first we determined the effects of hawthorn on inositol phosphate (InsP)- formation in neonatal mice cardiomyocytes. In isolated ventricular cardiomyocytes, hawthorn tablet extract caused a concentration-dependent increase in InsP formation. Future investigations will focus on 1) hawthorn extract effects on inositol triphosphate (IP3) formation, and 2) muscarinic receptors involvement in hawthorn-induced InsP formation.

179. EFFECTS OF INCREASED CURRENT VELOCITY ON THE GROWTH OF JUVENILE CAPTIVE BROODSTOCK COHO SALMON (*ONCORHYNCHUS KISUTCH*)

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To help rehabilitate the endangered population of coho salmon, *Oncorhynchus kisutch*, in the waterways that flow into the Monterey Bay National Marine Sanctuary, the National Marine Fisheries Service is working with the Monterey Bay Salmon and Trout Project on a coho captive broodstock program. Data collected from spawning both captive broodstock and captured returning wild coho during the first two years of the program shows that on average, the captive broodstock fish are shorter and lighter than wild returning coho. It is important to rear larger captive broodstock females because larger females have higher fecundity rates, larger eggs, and a higher hatch out success than smaller females. One way to possibly rear larger females is with increased current velocity. Current velocities in the rearing tanks of the captive broodstock may not be representative of current velocities wild coho experience, and this could be a contributing factor in the observed difference in size between the wild fish and the captive broodstock. To test this hypothesis, two groups of young-of-year coho were reared for two months in identical tanks, one group had nominal current, and one group had increased current velocities of ½ to ¾ body-lengths per second. At the end of the trial period, no statistically significant ($P>0.05$) differences in weight or length were observed between the two treatments.

180. ADDITIONAL RECORDS FOR PACIFIC HADAL ZONE ECHINODERMS

K.D. Trego. Nautilus Oceanic Institute, La Jolla, CA 92037

The Scripps Institution of Oceanography Benthic Invertebrate Collection has three echinoderm lots from the hadal zone of the Pacific Ocean. A specimen of the holothurian species *Myriotrochus zenkevitchi* was collected at 7540 meters in the Peru Chile Trench. This is the second record for this species in the hadal zone of the Peru Chile Trench. *Myriotrochus zenkevitchi* is found in the hadal zone of the Pacific Ocean. Ten specimens of the holothurian species *Elpidia atacama* were collected at 6894 meters in the Peru Chile Trench. *Elpidia atacama* is restricted to the hadal zone of the Peru Chile Trench and this is only the second collecting record for this species. A specimen of the asteroid species *Eremicaster pacificus* was collected at 6650 meters in the Canton Trough. This is the first Central Pacific hadal zone record for this species. *Eremicaster pacificus* is a cosmopolitan species which has previously been reported from the hadal zone of the Eastern Indian Ocean, Western and Eastern Pacific Ocean and the Southern Ocean.

181. WHALE FALL DEPLETION AND ECOSYSTEM EFFECTS FOR ABYSSAL/HADAL MEGAFAUNA ECHINODERMS

K.D. Trego. Nautilus Oceanic Institute, La Jolla, CA 92037

The subject of whale hunting and the subsequent depletion of whale fall habitats has been discussed in light of the possible extinction of obligatory whale fall species. For abyssal zone megafauna echinoderms,

the absence of whale fall habitats means the absence of a possible food source. Megafauna echinoderms in the abyssal zone are non-obligatory animals and are not dependent on whale fall habitats for survival. Echinoderms such as the holothuroid species *Scotoplanes globosa* and the echinoid species *Cystocrepis setigera* have used whale fall habitats as food sources. In the hadal zone, megafauna echinoderms may use whale falls as a more important food source because of the extreme hadal depths where other organic material sources are more limited. The holothuroid species *Elpidia glacialis* has diversified populations in different hadal trenches and in some instances have been trawled in very large numbers. The subspecies *Elpidia glacialis kermadecensis* has been collected in numbers up to 3000 individuals per trawl in the extreme depths of the Kermadec Trench. A significant food source in the hadal environment is required to sustain such large populations of holothurians. Whale falls are possible significant food sources for megafauna echinoderms in hadal environments.

182. DYNAMICS OF PLANETARY INTERIOR OCEANS AND SURFACE EXPANSION OF POTENTIAL ECOSYSTEMS

K.D. Trego. Nautilus Oceanic Institute, La Jolla, CA 92037

Internal oceans in solid planetary bodies in the solar system are potential ecosystems. The outer planet ice satellites with significant resurfacing (Europa, Enceladus, Dione) possibly have internal oceans with periodic surficial flow. Internal oceans of ice satellites have surficial flow due to tidal forces and volcanism. Possible organisms from these internal oceans might survive in the frozen surface of these ice satellites. On Mars, there may be a large aquifer system in the regolith that might be considered an internal ocean. Surficial oceans may have existed early in Mars' history. Resurfacing of an internal Martian ocean would result from volcanism and gravitational transport of unconsolidated material which would expose aquifer layers. Possible organisms of an internal Martian ocean may survive on the planet's frozen surface.

183. SEASONAL AGGREGATIONS OF FEMALE ROUND STINGRAYS (*UROBATIS HALLERI*) IN A COASTAL ESTUARY

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Despite a large seasonal aggregation of round stingrays (*Urobatis halleri*) in Seal Beach, CA, no behavioral or physical evidence of mating has ever been observed. Mating in this population is thought to occur in nearby Anaheim Bay estuary, which is part of the Seal Beach National Wildlife Refuge (SBNWR). SBNWR is composed of 1.1 km^2 of estuary and four mitigation ponds. With muted tidal flushing, the mitigation ponds experience very seasonal temperature ranging from 10.9°C in winter to 29.3°C in summer. Round stingrays were sampled every other week from June 2005 to September 2006. All captured rays were weighed, sexed, and examined for mating scars as evidence of recent breeding behavior. From June 2006 to September 2006 blood was sampled via the caudal vein from a subset of rays and analyzed for progesterone and estradiol using radioimmunoassay. Rays exhibited strong sexual segregation with only one male being captured out of 428 rays sampled throughout the study period. There was little variance in size of adult females captured, with averages ranging from 188–203.5 mm disc width ($p>0.05$). Progesterone levels were elevated in females sampled through July and August (0.75 ng/ml) and levels decreased significantly to 0.16 ng/ml by September. The density of females appears to be regulated by temperature and correlated with reproductive state. Female round stingrays may be entering these warm shallow ponds to increase the gestation rate, purported to be three months, which is relatively short for a live bearing elasmobranch.

184. CIRCUIT DYNAMICS AND MODELING OF THE GAUSS ACCELERATOR

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The Gauss Accelerator, commonly known as the Gauss or Coil Gun, demonstrates potential for future use in military and space applications. However, efficiency is miniscule due to a lack of elucidation of

factors that affect the performance of the Gauss Gun. But since the Gauss Gun functions as part of a time-dependent circuit, the circuit itself should play an immense role in the efficiency of the accelerator. Setting parameters for a theoretical, ideal circuitry and design of the Gauss Gun was attempted through the use of Fourier Transforms and Magnetic Field equations. The field model predicts that radial expansion of the Gauss Gun optimizes muzzle velocity and flux density, and energy calculations predict that on some level, higher circuit resistance is beneficial to the system. Experimental results show that between 0–10 amperes of current, 10 Amperes was least effective and 4 or 5 amperes were most effective for projectile distance. Fourier transformations also prove to be valuable tools for future optimization of time-dependent circuitry and dynamics of the Gauss Accelerator by frequency adjustments in AC.

185. A STUDY OF ENTEROBACTERIACEAE AT TWO ENCLOSED BEACHES IN LOS ANGELES, CALIFORNIA

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The purpose of this study is twofold. The first goal is to compare the densities of fecally derived bacteria found in two aquatic systems, to see if these differences could be attributed to bird populations, and to identify specific strains of these bacteria. The second goal is to compare relative fecal indicator bacterial densities in shore water and adjacent sand. This will help us better understand the microenvironment of our coastal estuaries and the influence of tidal variation on human illness. There were significantly higher bacterial levels in Del Rey Lagoon than in Mother's Beach, which may be attributed to the higher quantity and diversity in the Del Rey Lagoon. Although there was no significant difference between sand and water levels on all but one day, the standard deviations of the sand samples were often significantly higher, most likely due to the presence of bird feces in the sample collected. Based on the metabolic responses indicated by the VITEK system, the *E. coli* measurements obtained using the IDEXX system may represent a variety of Enterobacteriaceae species.The data produced will be valuable in developing a better understanding of the microenvironment of Southern California's water systems. Once the specific bacteria are identified, we can see whether these bacteria can be potential human pathogens. Source testing is the best way to assess the impacts of human usage and natural wildlife, which ultimately will impact water quality.

186. EXPLORATION OF PROTEIN LRP16'S FUNCTION AS A RESULT OF ITS CORRESPONDING DNA SEQUENCES THROUGHOUT THE EVOLUTIONARY TREE

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Using computational methods and analysis, the protein structure of LRP16 was compared throughout six different species, allowing for variety of location on the evolutionary tree. The areas of conservation throughout evolution were located, analyzed, and determined to be primarily in the macro domain region. The predicted function of macro domain, an ADP-ribose bonding molecule, was determined and compared with the information from several recent studies suggesting the over-expression of LRP16 in breast cancer cells. The predicted function was concluded to suit the findings of another study, meaning it can potentially be a factor in the protein's over-expression. The results of this study suggest that the protein LRP16 is affiliated with breast cancer.

187. PERMANENT UPLIFT OF THE MENTAWAI ISLANDS AND THE MEGATHRUST EARTHQUAKE CYCLE

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The Sunda megathrust fault off the west coast of Sumatra, Indonesia has experienced big earthquakes in recent history. The section of the megathrust south of these ruptures, beneath the Mentawai Islands, could rupture in the coming decades. I mapped geomorphic features of the Mentawai Islands to observe evidence of any long term uplifting that might be tied to permanent uplift during great earthquakes. The features I focused on were flat terraces and uplifted sea cliffs. By mapping the distribution of terraces, I hope to identify uplift caused by previous earthquakes. I formulated the hypothesis that if the terraces on the

islands are caused by permanent uplift due to earthquakes, then there should be apparent stair steps from the edges towards the center of the islands. I did not observe the stair steps of uplifted terraces, so there may be some other cause of the terraces I mapped. I conclude that there is not rapid uplift of the islands that is linked to each megathrust earthquake. Instead, each island could recover by sinking in between each earthquake. Field study in the islands would provide close observations of the terraces and help clarify why these islands don't simply rise with each earthquake.

188. PHYSICAL ASPECTS OF SOUTHERN CALIFORNIA BEACHES AND HOW PEOPLE PERCEIVE THEM: CONSIDERATIONS FOR BEACH NOURISHMENT PLANNING

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Southern California beaches are world famous and provide valuable economic, environmental, public safety, and shore protection benefits. Much attention is paid to beach width, erosion rates and shoreline change. And recently, economists have undertaken surveys and research to quantify the value of beaches to the local economy and the value of a day at the beach. To date, little attention has been paid to either the aesthetics of beaches or the public perception of beaches. This study attempts to characterize the physical aspects of beaches through a recent set of field surveys at 107 beach locations along 200 miles of the southern California coast. These findings are then compared to a "Beach Sand Survey" given to 225 people assessing how people perceive southern California beaches.

Results of the first part of this study show that beaches in southern California have a dramatic variety of widths as well as sand types, colors, and textures. Tan and light brown sands dominate the northern beaches and light gray to dark gray sands are common in San Diego. The "Beach Sand Survey" results reveal that people have a wide variety of reasons why they enjoy going to the beach – mainly involving exercise and relaxation. People also have wide ranging perceptions concerning our beaches. For example: While most prefer moderately wide beaches with fine texture sand, some favor very narrow and pebbly beaches, noting that these types of beaches may be adjacent to the best places for either surfing or tide pooling. The "Beach Sand Survey" also asks whether people are in favor of restoring Southern California beaches using beach nourishment if erosion has unfavorably narrowed them. People have mixed opinions regarding bringing new sand onto the beaches, yet the majority favor nourishment and are willing to pay an extra tax to have their beaches restored. The findings from this study may provide insight into future beach nourishment planning and may assist in understanding and/or establishing better beach management practices.

189. PRODUCTION AND CHARACTERIZATION OF EFFICIENT C60-TETHERED AU NANO-PARTICLES FOR THE DELIVERY OF PHOTOSENSITIZERS

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Singlet oxygen is the first excited state of oxygen that is a strong electrophile that can react with amino acids, peptides and other biologically relevant molecules. Here we study the oxidation of C-60 tethered Gold nanoparticles by singlet oxygen, $^1O_2$, for said nanoparticle's possible application as an efficient carrier of photosensitizers.

190. THE SIGNAL TRANSDUCTION PATHWAY FOR MUSCLE CELL APOPTOSIS IN AGING AND INJURY

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Muscle cell apoptosis has been implicated in the gradual loss of muscle mass in aging, also known as sarcopenia, as well as in cell death after muscle injury. It has been previously shown that an intrinsic (mitochondria-dependent) pathway causes this apoptosis. However, little is known about the key molecular components of the signal transduction pathway.

This study tested the two causes of apoptosis (aging and injury) with two separate arrangements of tissue samples from the mouse, Mus musculus. Tissues were taken from the gastrocnemius muscle after cardiotoxin injection (for the injury model) as well as from mice of different ages (for the senescence model). Changes in chemical concentrations such as G6PDH, 4-HNE, iNOS, BAX, and BCL-2 were examined with immunohistochemical analyses for the aging model; Western Blot techniques were used to analyze JNK and p38 MAPK induction. The results indicated that, in the aging model, oxidative stress slows the metabolism, causing JNK to phosphorylate BCL-2, perturbing the BAX/BCL-2 rheostat. This allows cytochrome c to escape from the mitochondria and activate caspase 9, which in turn activates the executioner caspases 3, 6, and 7. The same pathway seems to apply to muscle cell injury. The data showed that p38 MAPK and JNK are both activated after cardiotoxin injection; injury caused the same chemical changes as aging.

Overall, it has been shown the p38 MAPK and JNK are critical components of the apoptotic signaling pathway in injury and that oxidative stress and iNOS expression seem to be key elements of muscle cell loss in aging. This information will help to find a way to prevent sarcopenia and possibly remedy other muscular disorders.

191. A CASE-CONTROL STUDY OF COMMUNITY-ACQUIRED METHICILLIN RESISTANT *STAPHYLOCCUS AUREUS* SKINAND SOFT TISSUE INFECTIONS AMONG INMATES IN THE LOS ANGELES COUNTY JAIL

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Staphylococcus aureus is among one of the most versatile of human pathogens. *S. aureus* causes illness through the production of cell surface and secreted virulence factors. The organism is highly adaptive and has proven ability to adapt to the selective pressures of antibiotics within a few years of their introduction. It can be a common cause of life-threatening infections causing end to many lives. The LA County Jail provides for an ideal opportunity to study this disease process in a near epidemic environment. Los Angeles County Jail and Los Angeles County Department of Health Services personnel have called for increased budgeting to deal directly with the continuing outbreak and are eager to have more answers as to the epidemiology of CA-MRSA. This gives a chance to further investigate on the growing problem of CA-MRSA. Nasal swabs and administering questionnaires were obtained during a two-week time of all inmates willing to participate being processed through the Inmate reception center (IRC). The second phase of the project will entail accessing inmates at the medical clinic in the jail. Preliminary results indicate inmates with prior history of being homeless are more likely to have CA-MRSA infections. There were some risk factors such as homelessness, carries MRSA/Staph infection, taken antibiotic pills or liquid by mouth, spent long time in jail, the use of needles for self-injecting medications or drugs, shared space with someone that has a skin infection, or shared personal items such as razors, soap, and sheets. The risk factors that were found to be significant were homelessness, consuming antibiotic pills or liquid by mouth or antibiotic injection within the past months. Shared personal items such as soap, sheets were also found to be significant.

192. THE ABILITY OF *BACCHARIS SALICIFOLIA* TO ABSORB CADMIUM AS AN EFFLUENT: IMPLICATIONS FOR PHYTOREMEDIATION: YEAR TWO

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Cleanup of soil pollutants is often expensive and environmentally unsound. Phytoremediation is an area of frontier science that provides a safe and cost-effective alternative to the conventional cleanup methods. This study featured a native California plant, *Baccharis Salicifolia*, or mule fat, identified the maximum tolerable dose of cadmium that can be administered weekly as well as the implications for a large-scale phytoremediation project. The approximate maximum cadmium concentrations were determined by planting five groups of eight saplings. Cadmium was applied weekly via solutions of water and cadmium acetate in various doses. The saplings were observed during the eight-week growth period, and then harvested. Plant tissues were separated and analyzed via ICP-MS (Inductively Coupled Plasma Mass Spectroscopy), and cadmium content was determined in the leaves and shoots of various groups.

Average plant tissue dry masses in addition to leaf counts, shoot length measurements, and actual cadmium content in these tissues confirm that the maximum weekly dose tolerated by *Baccharis salicifolia* is somewhere between twenty-five and fifty parts per million. Beyond this level, the plant is no longer a practical phytoremediation candidate because the decline in overall health drastically decreases the mortality rate in the species.

As confirmed by the previous year's study, mule fat is a relatively plausible candidate for phytoremediation, though not necessarily better suited for cadmium as an effluent. Both a single large dose and multiple smaller doses demonstrate a similarly above-average tolerance for cadmium in Baccharis *salicifolia*.

193. PROTEASE INHIBITORS IN AUGMENT TEMOZOLOMIDE-BASED TREATMENT FOR MALIGANT GLIOMAS

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The use of HIV protease inhibitors in conjunction with temozolomide (TMZ) based chemotherapy for patients with malignant gliomas has never been attempted before. Protease inhibitors, which were approved by FDA on May 1999, are orally administered, and are generally very safe and well tolerated by patients. Protease inhibitors have been previously demonstrated to have anti-tumor, anti-angiogenesis, and anti-invasive properties in Kaposi's sarcoma. In addition, recent data have indicated that the protease inhibitors have radio-sensitizing and chemo-sensitization properties as well. First of all, in this experiment, we propose to demonstrate via *in-vitro* models (glioma cell lines and cell cultures) that protease inhibitors may be additive or synergistic in inducing cytotoxicity during combination treatment with temozolomide based chemotherapy. The best type of protease inhibitor and the proper dosage will also be determined *in-vitro*. Second, we will apply the same conditions to an *in-vivo* nude mice subcutaneous and intracranial glioma model. If the hypothesis and specific aims of this researches are realized, adding a protease inhibitor to the temozolomide based chemotherapy regimen that is currently used for upfront management of malignant gliomas may be done more easily and safely, something that will hopefully reduce the malignant gliomas from a fatal disease to a less severe chronic illness.

194. OXIDATION OF L-DOPA IN MUSSEL BYSSUS DISC ADHESION

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This experiment's main goal was to further investigate the role of the amino acid L-Dopa in mussel (*Mytilus edulis*) byssal adhesion and understand its importance in attachment. L-Dopa, which requires oxygen to be activated, is a plentiful and persistent protein in the composition of these byssus threads, raising speculation as to its assistance in the process of adhesion.

This project was comprised of two sections of data collection. The first focused on creating an experimental environment which was deoxygenated to prevent L-Dopa from forming. Observations and comparisons were taken between a control tank and this lowered dissolved oxygen tank. Threads from each artificial habitat were sequestered and subjected to the Arnow Reaction which told of their L-Dopa content through coloration.

When the mussels were removed from their tanks, the differences in thread production between the two tanks was noted. The experimental tank, unlike the control tank, had zero attached threads although entire threads and byssal discs were fabricated. The Arnow Reaction also visually demonstrated through its coloring that the deoxygenated threads were clear. They contained less L-Dopa, thereby explaining their problems with functioning.

These results illustrate the true importance of L-Dopa in mussels byssal disc adhesion. This protein acts as the glue that ties many of the reactions together, making the attachment method effective. This valuable find does not only pertain to mussels but all of biochemistry for L-Dopa can be now studied in other applications, even applied to man-made adhesives.

195. STUDY ON THE TRUNCATION OF CONVEX SYMMETRICAL POLYHEDRA

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Truncations of convex symmetrical polyhedra were investigated. Truncation planes were created at each vertex such that the plane was perpendicular to the line from the center of the polyhedron to the vertex. These planes were pushed into the polyhedron with respect to a parameter and truncated the polyhedron. A computer algebra routine was created in order to automate this process and produce a new polyhedron with simply input of an original polyhedron and the parameter of truncation. Three types of truncation were encountered with respect to the depth of the cut. The first, a shallow truncation, was a truncation in which the truncations planes only interacted with the original polyhedron and not each other. This type of truncation related to a parameter value such that the cut was very shallow. A deep truncation occurred when the truncation planes began to interact with each other as well as with the old polyhedron. The final truncation, a dual truncation, occurred when only the truncation planes were interacting with each other to produce the new polyhedron. This point became a point of stability because any parameter value that cut further into the polyhedron would only scale the outcome of the dual truncation, which is the polyhedron's dual.

196. PREDICTING LUNG CANCER RELAPSE USING LEVELS OF 2881 PROTEINS

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A major problem with cancer and other gene-related cases is that there is so much data to sift through. Even though scientists have been able to measure each of the approximately 25,000 genes in the human genome, they have no way of identifying patterns associated with gene-caused illnesses because the data range is so large. Even if the search were narrowed down to a relatively small number of genes, the potential for combinations between the genes would still generate a large search area. This study attempts to search through a bank of genes to find certain genes that are associated with lung cancer relapse. 2881 genes from 39 patients are analyzed by computer algorithms such as J48, IB1, and Naïve Bayes. Two genes were found to be significant. The importance of pattern finding and the significance of the two genes are talked about, as well as the importance of computers in aiding the search for causes of sicknesses related to genes.

197. PROTOCOLS FOR *HALIOTIS RUFESCENS* EGG CRYOPRESERVATION AND *IN VITRO* FERTILIZATION (YEAR 2)

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Gamete cryopreservation can play an important role in conservation strategies for at-risk abalone species. Objectives of this study were to continue investigating red abalone egg cryopreservation protocols by determining whether eggs which exhibit normal phenotypes after thawing could be successfully fertilized with live sperm, and by evaluating propylene glycol (PG) as an alternative cryoprotectant agent (CPA) to dimethyl sulfoxide (DMSO).

After induced spawning and egg collection, eggs were frozen using cooled or uncooled DMSO or PG at 8 and 16 mins stepwise cooling at 14, ≤4, −40 degrees C, before plunging into liquid nitrogen. 26 stepwise thawing protocols (5 mins at −40, ≤4, 14 degrees C with 1.25 g or 2.5 g non-permeating sucrose/80 ml water) and 20 *in vitro* fertilization tests were conducted.

Protocols using PG at 8 or 16 mins stepwise cooling and stepwise thawing at with 1.25 g sucrose, yielded 90% to100% (8 mins) and 75% to 80% (16 mins) intact round eggs with clear chorion. PG protocols using 2.5 g sucrose during thawing yielded less than 10% such eggs. DMSO stepwise cooling (8 and 16 mins) and stepwise thawing (1.25 g or 2.5 g sucrose) protocols yielded 10% to 25% intact round eggs displaying little or missing chorion. Sperm orientation towards eggs during *in vitro* fertilization attempts occurred only in PG trials. No cell division occurred.

PG appears to be the more effective CPA, as chemical signaling between sperm and eggs, with release of egg chemoattractant (L- tryptophan), remained bioactive after cryopreservation. CPA toxicity, ice

crystallization or other factors may have caused egg damage and prevented fertilization. Further research will involve refining protocols.

198. MAGNETORHEOLOGICAL FLUID SHEER STRESS AND THE MORPHING OF AIRPLANE WINGS

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Magnetorheological fluid is a prime example of today's smart fluids. The fluid is normally hydrocarbon based and contains suspended magnetic particles whose dipoles align with magnetic field exposure.

This project aims to study the shear stress of magnetorheological fluid. Shear stress is defined as stress which is directed parallel to the material's face, in this case the magnetorheological fluid. Furthermore, the project aims to provide a manner in which magnetorheological fluid can be applied to the morphing of airplane wings.

Shear stress measurements were taken as the magnetorheological fluid was exposed to varying magnetic fields generated by an electromagnet through which different voltages were run. The stress was measured using a simple pulley system and a glass plate which rested on a thin mm of the magnetorheological fluid. Upon activation of the magnetic field at varying voltages, weights were attached to the end of a string which ran over the pulley. The other end of this string was attached to the glass plate. Upon "shearing" one centimeter, the weight required was recorded and shear stress measurements were completed for the varying voltages. Measurements such as these were taken also at varying thicknesses of magnetorheological fluid.

As voltage of the electromagnet, and therefore magnetic field strength increased, the viscosity of the magnetorheological fluid also increased. This increase in viscosity correlated closely with an increase in shear stress; therefore, as voltage supplied increased shear stress increased.

Information gained from the sheer stress of magnetorheological fluid can be applied to the morphing of airplane wings. Airplane wings can be made to resemble a bird's wing with individual feathers. These individual "feathers" of a complete bird wing would be translated into several different pieces of a single airplane wing. Each "piece", through magnetorheological fluid shearing, can be shifted to varying positions to morph the wing as a whole.